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Evaluation of a Biomedical Science Clinical Training Curriculum

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Maria Wan-Yin Wong

A Thesis submitted in Partial Fulfilment of the Requirements for the

Degree of Doctor of Education

School of Education

University of Durham

2004



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Evaluation of a Biomedical Science Clinical training Curriculum

Thesis submitted for the Degree of Doctor of Education, University of Durham, 2004.

Maria Wan-Yin Wong

ABSTRACT

The thesis is concerned with quality in clinical education. It explores issues pertaining to the effectiveness of a biomedical science clinical training program through an evaluation. The aim is to gather and analyze program data for the improvement of student learning. Mixed methods including self-completion questionnaires and semi-structured interviews were used to explore students' and clinical teachers' perceptions in the domains of clinical teaching, student learning, organization of the program and personal gain. Two questionnaires were developed for data collection on two consecutive cohorts of students of the Hong Kong Polytechnic University and clinical teachers from various training hospitals. Interviews with laboratory managers were used to support quantitative data of the questionnaires. Analyses of data from the first cohort revealed some deficiencies in the program including communication of goals to students, practice opportunities, shortage of clinical teaching staff, lack of initiatives from students, and inadequate communication between academics and laboratory teaching staff in the first phase of the study. The findings were reported to both academic and clinical teachers. Measures were taken to resolve these issues such as a comprehensive pre placement briefing for the students, to encourage clinical teachers to adopt different teaching strategies to foster student learning. Post training perceptions between the two cohorts were not significantly different in the second phase of the study except a slightly higher rating in the category of practice opportunities. It appeared that the intervention had not produced large effects. However, the results with implications were presented to the university, hospitals and students for further enhancement of student learning. It is through this continuous feedback mechanism that effectiveness of the program can be sustained.

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Declaration

I declare that the thesis submitted is entirely my own work except where due acknowledgment is made. All materials presented in this thesis has not been included in a dissertation for which a degree has been conferred.

Chapter 1 Introduction

Organization of the Thesis

This thesis is presented in six chapters.

Chapter One – this introductory chapter attempts to establish the relationship between quality and evaluation and to provide the background for the purpose of the study. It first addresses the contemporary issue of concern of quality in education and differentiates the different conceptions of quality as perceived by different people. It then examines the guiding principles, the roles and goals of evaluation and how it can form the basis for systematic investigation in the effectiveness of a programme. This is used to link up evaluation as a means to better understand and improve quality. It then reviews various evaluation models to explore the concepts that help to shape the design of the study.

Chapter Two – is a review of the literature on clinical education to provide a better understanding of its nature, processes and outcomes. The chapter addresses the important elements that may influence the quality of clinical education including clinical teaching, role of the clinical teachers, the learning environment, students' learning approaches, practice, feedback, communication as well as ethics and anxiety which form the basis for the evaluation.

Chapter Three – considers the methodology. It first introduces the Biomedical Science clinical training programme of the Hong Kong Polytechnic University. It then describes the sample, the development of the instruments and methods employed to assess the processes and outcomes of the programme.

Chapter Four – gives a systematic report based on the perceptions of students, clinical teachers and laboratory managers on the four constructs of clinical teaching, learning, organization and personal gain. Results are presented in tables and figures for interpretations.



Chapter Five – how do the findings of the study relate to the major issues of clinical placement, the selection of effective change strategies and in improving quality of learning are discussed by drawing comparisons with previous research. Strengths and limitations of the study are also elaborated.

Chapter Six – conclusions are made with reference to the results. Implications are drawn for the university, service facilities and students. In the final section, suggestions are offered for future research to further improve the programme.

The Issue of Quality

Quality has become a global concern in higher education in the recent decades. The issue of quality is much debated within both the education and the public sectors and is widely discussed in many international conferences and seminars. What constitutes the controversies on quality and its role in education?

Green (1994) offers a few reasons for the current search for quality in education. He makes a key point when he points out that the rapid expansion in higher education in recent years has incurred substantial cost for the government. In order to keep public expenditure under control, provision of funding to tertiary institutions is proportionately less than the increase in the number of students. With increasing competition within the educational 'market' for resources and students, university and colleges are asked to do 'more for less', higher education institutions must therefore demonstrate their worth.

Frazer (1992) suggests that accountability to society, students, employers and professional colleagues is the notion that higher education is held responsible for. Institutions have the responsibility to ensure that the best knowledge and skills are made available to the students and their interests are not compromised. Teachers are accountable to their professional colleagues that the integrity of their discipline is upheld. Since funding comes from taxpayers, universities are accountable to society to ensure what they provide has value for money.

According to Veddard (1992) and Craft (1992), people have lost confidence and faith in the virtues of education and the 'ivory tower' image of tertiary institutions is no longer seen as a guarantee of excellence but expect independent evidence to show that quality education is delivered by these institutions.

Furthermore, Winch (1996) argues that concerns about quality in education are largely influenced by the philosophy and quality concepts such as total quality management, production control, and meeting customer needs from the business world. However, he cautions that commercially based concepts of quality and systems of quality assurance should not be imported to education without reservation, as there are significant differences between the two worlds (commercial and education). For example, although both sectors have pre-determined values which influence the way they operate, educational institutions are seeking to instill these moral laden values to their students, to change their values and perspectives, rather than just to influence them to come back and buy the product or service again.

With the transition from elite to mass higher education, academic standards are not a private matter anymore, as Randall (2001) claims. Its relationship with the society has transformed and this phenomenon is seen in different countries of the world. He concurs with Green (1994) that universities are now subject to new pressures of having to increase the number of students. While governments are finding it difficult to provide funding to a mass participation system at the rate as generous as they used to do, universities are increasingly called upon to provide evidence for maintaining standards and quality.

Most higher education institutions respond to these external challenges and pressures in a similar fashion (Randall 2001), by changing internal structures and organization, developing different teaching and learning strategies, and by adopting various quality assurance approaches to meet with the unprecedented demand for quality (Thune, 2001; Lemaitre, 2001).

What is meant by Quality?

Rissom (1992) suggests that the term 'quality' is neutral and value free. It has no absolute meaning but is dependent on the context in which it is being placed and on the objectives that are set. The positive implications and the association with 'good quality' on the use of this term are often illusory, as quality is only a relative concept and it would be better reflected when its quantitative aspects are being taken into account.

What is clear is that quality in higher education is a pervasive, but elusive concept, is multi-faceted, requires judgments by people with experience, and cannot simply be equated with excellence.

Frazer, 1992:14

Green (1994) resonates with Frazer's idea of quality being an elusive concept. There is no simple answer, and the answer is dependent on who is making the judgment and for what purpose. So who is making the judgment? There are many interested parties in higher education including the universities, staff, students, employers, parents, the funding agencies, auditors, assessors and so on. Each stakeholder is likely to have a different perspective on quality, influenced by his own interest.

Green (1994) identifies four approaches for assessing quality in higher education: The traditional concept - quality of a product is linked to its distinctiveness and exclusivity. It is judged by setting extremely high standard for its production, for example, education offer by Oxford and Cambridge has traditionally been regarded as excellent. Secondly, quality can be assessed in terms of conformance to a specification in which certain characteristics of the products are measured. Thirdly, quality is examined according to the extent to which a product meets its stated purpose or fitness for purpose. Fourthly, quality is judged by its ability in meeting the needs of customers.

Winch (1996) presents similar concepts of quality in education which he terms as prestige, conformity to standards, customer satisfaction and fitness for purpose. In addition, Winch also argues that since education is a public good, cost or value for money is another factor to be considered, for example, an increased number of graduates for the same amount of funding.

Yet another term 'value-added' has been used in recent years as a criterion for quality (Astin, 1993; Radford, 1997). To some people, value-added embraces the amount of progress made by students or the gains that students have as a result of a learning experience. What a student knows at the beginning of an educational experience can be compared to what the student knows at the end and the difference between the two measurements will yield an educational value-added. However, graduates from Oxbridge may not be regarded as having a higher value-added when compared to graduates from a vocational institute, as the Oxbridge students are in general more able students to start with than students of the vocational institute. Therefore, value-added measures need to be handled with care for they may carry different connotations in terms of gains in different situations. This leads to a more sophisticated view of value-added as being the relative progress of students. That is to say the extent to which they have made more or less progress than students with similar starting points. The concept is widely used in schools (Tymms, 1999).

The elite approach may not be applicable in this day and age, particularly when there is the movement to mass participation in higher education. As Radford (1997) argues, one should consider a general level of competence attainable by all, which means if there is a high percentage of students graduated satisfactorily in a university, quality is implied.

'Fitness for purpose' raises the issue of the purpose of higher education (Winch, 1996). However, the higher education system is extremely heterogeneous, ranging from elite institutions such as Oxbridge and the Ivy Leagues to community colleges, and each individual institution has its own purpose. Therefore, it would be difficult to compare quality between institutions as there are no common standards that can be used for measurement.

The nature of higher education has changed, partly due to its rapid expansion that stem from mass participation and partly due to the issues of accountability and competition for funding. Attention to quality is increasing. Higher education has to make more explicit to different interest groups what institutions provide, the way they provide and how good the result. One of the ways of communicating its unique characteristics at programme level or institution level is to describe its quality. Standards or performance indicators are then used to express the magnitude of quality to the public. These would serve as yardsticks or benchmarks to enable various stakeholders to form an opinion on its worth.

However, with so many different stakeholders, such as students, employers, taxpayers, government, funding agencies, each having their own interest or priority, it would be difficult to have a consensus on quality. Hence, definitions of quality vary as it involves the judgment of individuals and that is governed by one's values and priorities. Therefore, it would be important to have a clear view of the criteria on which such judgments are made to know who are the interested parties making the judgments, so that appropriate approaches and methods can be used to assess quality.

Quality assessment approaches

As a result of the increased demand for accountability for public funding and the movement to a mass education system, concerns about academic standards and their maintenance had arisen. More emphasis is placed on both internal and external mechanisms to measure quality in higher education and different approaches are developed, including quality control, quality assurance, quality audit, quality assessment, and performance indicators.

Quality control – This system is concerned with the testing of the products to see if they meet specifications (Winch, 1996). A major drawback about this system is that the inspection for quality is usually undertaken at the end of the production, hence, it may prevent defective products to be delivered to the customers but it cannot prevent waste and loss of time during production. Therefore, within higher education quality control would verify, usually post hoc, if teaching and learning are carried out in a satisfactory manner. This may be

problematic in education for if teaching and learning are not delivered right the first time, it may be costly to the students, for once being delivered, it could only be improved in the next group of students.

Quality assurance – This system encompasses all the policies, and processes directed to ensure the quality of higher education provision are maintained and enhanced. This system is derived from Deming's theory of quality assurance in which everyone in the enterprise has a responsibility for the quality of service delivered (Frazer, 1992) and involves all the mechanisms to ensure defective products are not produced. The 'fitness for purpose' approach is adopted rather than 'conformance to specification' as the quality criterion (Winch, 1996). Everyone in the institution should understand, practice and assume ownership of the system. It is only through total commitment of every member of the organization that any guarantee of quality service can be carried out (Perry, 1994).

Quality audit – Quality audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the stated objectives (BSI 7229). A scrutiny is performed by an external group of an institution's documented evidence to prove if the quality assurance arrangements are satisfactory and effective. Quality audit is neither concerned with the validity of an institution's objectives nor directly with academic standards but only if the processes are in place (Webb, 1994).

Quality Assessment – is concerned with the operational techniques of assessing the actual provision of quality education. Quality assessment does not have to be norm-referenced (Frazer, 1992), for standards can be defined to be met for each level and each aspect in education by individual institution. Hence, institutions having higher aspirations will have higher standards, thus making it more difficult to achieve its goals. However, the essence behind quality assessment is for the purposes of quality improvement, self-regulation and accountability to the public (Vroeijenstijn, 1992). Through critical self-assessment by the institution or faculty, weaknesses can be identified and changes and improvements made.

Performance Indicators – In order to assure quality, measurements have to be made. Performance indicators are signposts used to demonstrate the extent to which schools and academic departments are achieving desired results (Liston, 1999). Indicators are pieces of information collected at intervals to reflect efficiency and effectiveness. They are developed to assess and monitor the extent to which each institution or department meets the measurable components of its objectives. There can be both quantitative and qualitative indicators. Quantitative indicators are often simple numerical data, while qualitative performance indicators involve elements that contribute to quality. Since education is value-laden, a key indicator of quality is the long-term gains that accumulate during progress through education, for example ethical values, standards of behavior. However, these are some objectives of universities that are not easily subjected to quantitative measurement (Tam, 2001).

Quality Assurance of Higher Education in Hong Kong

For the past decade, Hong Kong has been faced with the challenge of many new developments in its higher education. There is the emergence of distance learning, development of cyber consortium as well as a rapid expansion of post-secondary education. Higher education has expanded from a participation rate of 9% of the relevant age group in 1989 to a rate of 18% in 1994/95. The sheer size of higher education had almost doubled in 5 years. Although there was a consolidation of this growth in local universities in the 1990s, demand for educational opportunities remained high, as could be seen by the increase in non-local education programmes coming to operate in Hong Kong. Further, in the year 1999, the Education Commission carried out a review of the entire education system of Hong Kong and had proposed reforms in a wide range of areas including the expansion of educational opportunities. The Reform Proposals suggested the establishment of community colleges to offer sub-degree programmes for learners as ‘an alternative route to higher education’ and ‘a second opportunity to learners who have yet to attain qualifications at secondary level through formal education’ (Education Commission, 2000). In addition, it also provides an overall direction of life long learning. Clearly, the government has stated its goal for further expanding the post-secondary and higher education.

Given the pressure of increasing student numbers and a declining provision of funding from the government, higher education in Hong Kong is faced with the question of quality of education, largely on the relationship between quantity and quality. In order to address the issues of accountability, assuring value for money, and providing confidence to a more questioning and cynical public (Dunkerley and Wong 2001), higher education institutions in Hong Kong, in common with institutions of other parts of the world, respond to these pressures by exerting greater focus at all levels to embrace quantity and quality assurance. Universities have to examine their organization structures to make better use of resources to improve efficiency and to review qualitative aspects of teaching and learning to improve effectiveness.

How can quality be assured?

As Frazer (1992:18) attests, 'real and enduring quality can only come by actions of the universities themselves, inspection and quality control imposed solely from outside world would not work'. Hence, although there are external assurance processes in place to monitor the quality in higher education, such as quality audit and accreditation, real effort has to stem from the universities themselves to safeguard the quality of education. It is through the commitment of every member within the system that quality could be upheld.

Hoy, Bayne-Jardine and Wood (2000) see quality in education as being inherent in a product and can be achieved by involving all interested parties, the school, the teacher, the parents and students in the process of developing students' learning. According to Hoy and associates, the essence of quality is the continuous effort and practice on improving the education. The institution should be more proactive, to focus on the improvement process and to encourage a self-developing quality culture to enhance educational performance so as to achieve excellence in education.

It is in this light of upholding quality in higher education that a quality assessment study was undertaken. This study intends to gather knowledge on a field training programme in the Biomedical Science curriculum of the Hong Kong Polytechnic University, and to provide feedback to the department on how well the

programme is functioning, to contribute information to decisions about programme provision. It is, therefore, the aim of this study to improve the quality of the programme through an evaluation exercise.

This thesis is about an evaluation of the effectiveness of a clinical training programme in the Biomedical Science curriculum. It is believed that a well-conducted and successful investigation requires a sound understanding of why and how we are doing it. Therefore, the following literature review will attempt to provide the necessary principles and concepts which form the framework of this thesis and the study.

Evaluation means 'a study designed and conducted to assist some audience to assess an object's merit and worth' (Stufflebeam, 2001: 11).

Worthen and Sanders (1987) suggests that evaluation is a structural process in which relevant information is collected and compared to pre set standard for the determination of quality and effectiveness of a programme, project or curriculum.

Weiss resonates with Worthen's idea by defining evaluation as,

the systematic assessment of the operation and/or the outcomes of a programme or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the programme or policy.

Weiss (1998: 4)

The five key elements stressed by Weiss in her definition include the research nature of the procedures which has to be conducted in a systematic manner; the focal point of investigation, whether it is the process or outcomes that is to be evaluated; the determination of the merit of the programme by comparing the findings of the process or outcome to some explicit criteria and the purpose of evaluation which is the improvement of programme or policy.

Evaluation

It is difficult to define evaluation as it is illusive (Worthen and Sanders, 1987) and is often troubled by ideological disputes. Evaluation scholars and evaluation practitioners have different views on what evaluation is and bring in different concepts and methods to conduct evaluation. It is not surprising that there exists such a rich array of theories and concepts, as these scholars come from different backgrounds who embrace various views on education and inquiry.

There are diverse conceptions of educational evaluation. Hopkins and Stanley (1981) see evaluation as measurement. Tyler (1950) views evaluation as an assessment on how well a programme meets its objectives. Stufflebeam (1971) regards it as professional judgment on the effectiveness of a programme, as a means to collect information to assist decision-making or may even serve as a political function. Cronbach and Suppes (1969) argue that evaluation is a 'disciplined inquiry' and a scientific activity. Each of these views, often with opposing ideas, leads to the development of various models which has greatly influenced the practice of evaluation (Worthen, 1972).

Furthermore, the diversity in evaluation approaches is underpinned by different philosophies held by different evaluators. House (1980, 1983) has identified two major groups of evaluation approaches which he terms objectivism and subjectivism. Objectivism is concerned with inquiry to be performed in a scientific manner, in which results can be reproduced by others using the same techniques. On the other hand, a subjectivist evaluation is conducted in ways as understood by the individual evaluator and is largely dependent on his experience and expertise. Both approaches receive many criticisms. Objectivism is being criticized as biased, having hidden values and has limitations in addressing the complex and dynamic issues of education (Scriven, 1984; House, 1980) while subjectivist procedures are being regarded as "unscientific", which often leads to confusing results due to the non-replicable nature of the methods (Boruch & Cordray, 1980).

House (1983) attests that the metaphorical nature of our thinking, which shapes ideas and concepts, may influence the adoption of different approach to

evaluation. In addition, some evaluators may hold an utilitarian approach where they focus on the overall impact of the programme on all the subjects being affected or an intuitionist pluralist approach where benefits of individual subject is being considered (House, 1976).

Although Talmage (1982) considers these conflicting ideas have exerted tremendous influence in the development of the field of evaluation, philosophical differences can coexist, even in the same study. The key issue is that we have to understand the underlying ideologies of the different assumptions and the limitations of various approaches. Hence, the credibility of results, the analysis and interpretation of findings, the need to address hidden issues or to explore unknown phenomena and the satisfaction of clients become important factors for choosing a philosophical orientation (Worthen and Sanders 1987).

It is important to define and understand evaluation, because evaluation is a complex process and involves a number of distinctive activities such as determination of objectives, sample design, methods of investigation and techniques for data analysis. All these elements can be influenced by many external factors, for example resources and time. Only through thorough understanding of what evaluation is and how it is conducted that appropriate research questions can be developed, correct measurements to be undertaken, and relevant criteria applied such that the value and merit of a programme or policy can be determined and improvement of the programme attained.

Purpose of Evaluation

Evaluation is a dynamic process which involves diversified activities. The variety of information generated can accomplish many different purposes. Evaluation serves many roles in education, including provision of a basis for decision or policy making, to improve the quality of a programme, to assess the achievement of students, for accreditation of a curriculum, to monitor expenditure of a school, to improve public relation, to increase our understanding of the teaching and learning processes, to appraise the effectiveness of a course, or satisfy some of the expectations imposed upon the educational institutions from the outside. It is through this process that different stakeholders' needs can be

identified, that the best strategies can be selected to address these needs, that changes can be monitored. There is an unending list of all the purposes educational evaluation can serve. In order to respond to the different goals of evaluation, a variety of approaches underpinned by different ideologies and conceptions are developed.

Evaluation Models

Most methods used in educational evaluation are derived from social science research methods. In this thesis, we will attempt to review a few frequently used approaches to discuss the philosophy and thinking pertaining to each approach, to relate its uses and to examine its strengths and weaknesses to help to set the scene for further discussions.

Objective- Oriented Evaluation

The characteristics of an objectives-oriented evaluation approach is to define clearly the objectives or goals of an educational programme in terms of behavior and content, and then subsequently evaluate the extent to which the goals are achieved (Tyler, 2000). Tyler's rationale was first developed in 1929 and published in 1934 (Tyler, 1934). He conceived evaluation as a process of determining how well a programme met its objectives and proposed that evaluation to include the steps of: 1. to identify the objectives of the educational programme; 2. to define each objective in behavioral terms; 3. to identify situations where objectives can be shown; 4. to devise ways to present situations; 5. to collect data; 6. to develop means for measurements; and 7. to compare congruence achievement with stated objectives (Tyler, 2000:90).

The objective-oriented approach has greatly influenced the field of evaluation since the 1930s. Its emphasis is on outcomes and has been broadly used for many curriculum development and evaluation programmes. The wide acceptance of this model is due to its logical and scientific approach (Worthen and Sanders, 1987). Its simple and straightforward procedure of judging the performance of a programme by determining the extent of objectives achievement which renders improvements and maintenance has made it very attractive. The

extensive use of this approach over the years has stimulated the development of many techniques and instruments to support the measurement of outcomes in education. Although many educators strongly advocate this approach, critics have asserted that this approach neglects the importance of process in an educational activity and focuses only on the measurement of objectives rather than the judgment of merit or worth of a programme. It omits the side effects or outcomes that are not covered by the objectives. Goals are easily masked by the broad aims which makes them difficult to be discerned and is potentially hindering innovation in programmes (Worthen and Sanders 1987; Wolf, 1979; Robinson, 1984). These inherent drawbacks in the objectives-oriented approach may limit the scope of inquiry thus reducing the effectiveness of evaluation.

Goal-free model

Scriven (1973) recognized the limitations of the objectives-oriented approach. The lack of a judgmental role in Tyler's rationale did not appeal to him as a complete measure hence he developed the goal-free evaluation. This model holds a contrasting rationale to the objective orientation. Scriven believes that educational goals cannot always be specified in advance but have to be evaluated. It focuses on actual outcomes rather than what are expected to happen. By not establishing predetermined goals, perceptions of the evaluators will not be limited, all outcome can be picked up, both intended or unintended, positive or negative. This approach can prevent evaluator from developing a tunnel vision and as a result, it can reduce bias and increase objectivity. In fact, Scriven recommends the use of the goal-free evaluation as a supplement to the goal-focused method. The evaluator's concern is to assess if the performance of the programme matches the needs of the stakeholders. This is in agreement with the total quality management approach which emphasizes on customers' satisfaction.

The CIPP Model (Context, Input, Process and Product)

The CIPP model proposed by Stufflebeam (1971, 2000a) embraces the core concepts of context, input, process and product evaluation, as suggested by the letters in the acronym. House (1980) referred to it as a 'decision making approach' for it was developed for the purpose of providing information for decision-making

and accountability. This model is intended for use by administrators, policy-makers, teachers and others who need good information for both formative and summative evaluation. This approach requires the evaluator to work closely with the stakeholders. By employing the four interrelated types of evaluations, namely context evaluation, input evaluation, process evaluation and product evaluation, needs of the stakeholders can be identified at different levels, and appropriate information can be collected. The information will then be used to help the stakeholders to determine goals and objectives for programme planning; to allocate resources for programme structuring, to guide strategies for activities implementation, and to determine programme attainment or improvement.

Sharp focus is one of the major strengths of this approach, as informational needs of the stakeholders are identified at the initial phase of the evaluation. It allows the collection of data relevant only to the key issues or questions to be addressed (Worthen and Sanders, 1987). However, a major criticism is that the evaluator may lose his objectivity due to the close relationship with the stakeholders which may result in biased results.

Stufflebeam (2001) stresses the importance of the improvement orientation of this approach, and through the use of these four types of evaluation, administrators, policymakers and programme staff will be able to develop and implement quality programmes, to strengthen and improve existing services as well as meeting accountability.

The Illuminative Model

Evaluators who view traditional approaches to programme evaluation as overly mechanistic and restrictive, have turned to other methods. Parlett (1977) argues that the prevailing conventional evaluation procedures which requires pre-structured design, specification of objectives, development of measuring instruments are formidable and have posed a great deal of limitations on evaluative innovations. He contests that there should be a shift of thinking in evaluation from what he termed 'agricultural-botany' paradigm to an anthropology paradigm. He then proposes an evaluation approach which he called illuminative evaluation. He suggests that it is more appropriate to adopt a holistic approach to evaluate

educational programme. The aims of the approach would be to examine the entire programme, to study how it operates and the factors influencing its operation and effectiveness; to identify factors affecting academics' and students' teaching and learning; to discern problems arising from the process and to discover significant features of the programme. In other words, it seeks to illuminate a wide range of issues and problems. Parlett (1977) advocates the use of a naturalistic inquiry to study the programme. He emphasizes that the evaluative focus is on information collection but not decision making, hence, the practitioner's concern is with description, documentation and interpretation rather than measurement and prediction. He proposes that evaluators should first observe and record the ongoing events, then to inquire intensely on selected questions and to further explore relevant issues thus enabling the study to be more focused and finally to attempt to explain the causal relationship of factors with observed patterns.

Much discussion has evolved around the trustworthiness of the illuminative evaluation since its introduction. Worthen and Sanders (1987) argue that the strengths of this approach are its ability to address the needs of the stakeholders and its emphasis on examining the complex issues of education from different angles. By concentrating on the context of the programme, the audience can better understand the function of the programme and through intensive inquiries, new insights can be gained and information can be shared. Guba and Lincoln (2000) argue that while the rationalistic paradigm uses criteria such as validity, generalizability, reliability and objectivity to determine the efficacy of an evaluation process, the naturalistic approach can also be judged in terms of credibility, transferability, dependability and confirmability. They believe that this approach is credible as the evaluator can always check with the participants to see if the findings are believable. They also contend that if sufficient evidence has been collected, the approach can attain some degree of transferability. Furthermore, they suggest that although the emergent design of the approach makes it difficult to replicate the approach is stable. In addition, they claim that objectivity should be placed on the collected data but not on the evaluator, and by using different techniques to gather information, findings can be confirmed.

Programme Theory

As an increasing interest is placed on the factors and mechanisms that make a programme successful, attempts have been made to study the causal links between the inputs and outcomes of a programme. A group of researchers (Fitz-Gibbon and Morris, 1975; Argyris & Schoen, 1978; Bickman, 1987) propose the use of a programme theory based approach to evaluate programmes. Weiss (1998) suggests that by constructing theories or assumptions of why or how an activity may lead to certain outcomes, it can form the framework of an evaluation. Guided by this framework, the evaluator can develop appropriate questions to follow every step that is presumed to contribute to the outcomes. If the results turn out as anticipated, the evaluation would unfold the assumptions of how the programme has worked and the mechanisms and processes that lead to the attainments of these goals can be confirmed. On the contrary, if the findings do not conform to expectation, the evaluation can reveal which particular step goes wrong. It is through this model that the link between cause and correlation can be challenged (Fitz-Gibbon, 1996). A feature that distinguishes programme theory evaluation from other evaluation approaches is the building in of variables between programme activities and outcomes in the development of a programme model for measurement (Rogers, 2000). However, Rogers cautions that the causal relationships between these variables and outcomes are not so straightforward and can be influenced by external factors, the non-linearity of causal relationship and the choice and action of the participants in the programme. Weiss (1998) recommends the evaluator to have more than one theory available, such that in case one theory falls through, the evaluator can continue to pursue the evaluation through an alternative pathway. Since this approach involves detailed tracing of every step in a programme, explicit causal inference could be established. In addition, the revelation of intermediate outcomes in the course of study would provide early indicators on the effectiveness of the programme (Weiss, 1998). However, Stufflebeam (2000b) sees it as problematic. He argues that since most educational programmes lack a sound theory for which the theory-based evaluation is dependent on, it would impose too much effort on the evaluator and the programme staff to develop an appropriate theory. Moreover, the focus of the evaluator might be shifted to validating the theory rather than on the evaluation of the programme. Other researchers question the generalizability of the approach.

They argue that since each theory is developed within a unique context, it might be difficult to apply it in another setting.

Formative and Summative Evaluation

In 1967 Scriven introduced the terms formative and summative evaluations (Scriven, 1967). The essence of this model is best explained by the definition of Robert Stake, when the cook tastes the soup, that's formative evaluation; when the guest tastes it, that's summative evaluation. Formative evaluation is usually conducted at the developmental stage of a programme, to produce information for the programme staff to help improve the programme. It is often carried out by an internal member with a small number of subjects. Summative evaluation is concerned with providing information on the effectiveness of a programme after the programme has been developed. This information would be fed back to decision makers for decision making. The major differences between formative and summative evaluations are when the evaluation is performed and what the evaluation is for. Formative evaluation aims to determine what is working, and what needs to be improved at the early phase of a programme such that modifications can be made to strengthen it. Summative evaluation aims to judge the merit and worth of a programme after its implementation, and the findings would be used for decisions on the continuation or termination of the programme. However, we should not restrict the roles of these two evaluation approaches. Programmes are continuously evolving to adapt to its ever changing external conditions even after its developmental stage. A programme which is presently working may not work as well in two years' time, hence, data collected for current summative evaluation may also be used for formative purposes at a later date.

The approaches or models that have been reviewed so far are only some of the more commonly used evaluation approaches. In fact, since the time of Tyler, numerous models have been brought forward, for example, Stake's Countenance Model (1967) which emphasizes the description and judgment of the subjects that are being evaluated and his later work of Responsive Model which is designed to respond to the stakeholders' requirements (2000); Fetterman's Empowerment Evaluation (1996) which involves member of the programme to conduct self-evaluation and reflection to improve their programme, and many others. These

approaches represent individual authors' beliefs and conceptions on the work of evaluation. They may be drawn from widely divergent philosophical assumptions, they may focus on the objectives of a programme or the mechanisms that makes a programme works, but they may also share common features such as the examination of outcomes. Each model has its strengths and uniqueness that can help evaluate different aspects of a programme. On the other hand each approach has its weaknesses which limit its applicability. So, which is the best approach for evaluating a given programme? There is no correct answer to that. There is no single approach that will be able to address all issues or to provide all information for all the stakeholders. These alternative approaches provide us with ideas about how evaluation should be conducted, present to us different strategies and procedures, and provide guidelines for planning and analysis. Each approach has its own strengths and merits and can be useful. We do not have to adhere to a specific approach and it will be more advantageous to choose and combine elements of different approaches to fit a particular situation, 'Only an evaluation drawing on the best from various models can document the effect of the complexity of the teaching' (Madaus & Kellaghan, 2000:25). 'Evaluation was a house of many mansions and had room for a variety of approaches' (Weiss, 1998: 14).

Roles of the evaluator

Traditionally, evaluations are conducted either by an internal staff or an external evaluator. It has always been controversial about which is a better choice. The internal evaluator has the advantage of knowing more about the programme, understanding the organization, its structure, is familiar with its operation, interest and needs. However, an insider having such a close relationship with the programme may accept too readily the existing framework, may share many of the perspectives and blind spots of other members and may even be biased about the programme. Conversely, an external evaluator, having no obvious stake in the programme, can be more objective. Although she may not know as much about the programme, her preconceptions of a programme will be less influenced and be more neutral. Hence, she can examine the programme in a more impartial manner and bring in fresher ideas and provide better insights (Worthen & Sanders, 1987).

The different roles of an evaluator are vitally important in an evaluation. The evaluator is seen as a person who searches for evidence and understanding to see if a programme is achieving its goals and the mechanisms that render its effectiveness. She acts as a selector of evaluation designs. Since there are a great number of different designs, judgment call is often required from her to select the most appropriate model she deems fit for the purpose. Often, she needs to exercise her expertise and experience to design an evaluation; to develop different measurements to collect information; to assess, analyze and interpret data; to produce a credible report on the programme and to disseminate these results to her audiences in the hope that these answers will help people to make better decisions and to improve the quality of the programme.

Weiss (1998) points out that, in recent years, the traditional role of an evaluator as a dispassionate observer has been transformed. Some researchers advocate that the evaluator should assume a participative role in evaluations. Through advice and provision of assistance on the sidelines, the evaluator can coach members of the programme to conduct an evaluation on their own. The evaluator may also choose to undertake an evaluation jointly with programme practitioners and acts as a collaborator in the investigative work. Furthermore, the evaluator can become the facilitator in a stakeholder evaluation and to present views for the stakeholders. To involve programme members and other stakeholders in an evaluation could increase cooperation from staff to obtain more relevant information, thus enhancing the validity of the study. In addition, when staff participate in the evaluation process, they would be more receptive to the findings and more willing to accept recommendations for later use. However, the evaluator has to be cautious in the selection of participants in the programme for their differential backgrounds may influence the behaviors of other participants. Another issue that requires attention of the evaluator is to ensure the representativeness of the participants.

Issues of Evaluation

The goal of evaluation is to provide the best information possible to answer questions of the programme being evaluated. However, not all programmes warrant an evaluation. There are times when evaluation is inappropriate. For

example, when resources, funding, and time are inadequate; when qualified personnel to conduct the study are unavailable; when limits to what the evaluation can study are imposed; when data are inaccessible or when the programme is not stable. These constraints can hinder the evaluator in search of legitimate information and limit the success of an evaluation. Support and interest from the sponsors and stakeholders are also essential if evaluation findings are to be used, otherwise the evaluation would not be meaningful (Worthen & Sanders, 1987; Weiss, 1998). Therefore, it would be beneficial to examine the 'evaluability' of a programme to determine if an evaluation is appropriate prior to any undertaking (Wholey, 1994).

Evaluation is a complex process which involves many issues. Weiss (1998) thinks that it is important for evaluators to find out what the evaluation is for and who would use the results from the onset of the study. Different people would have different expectations from the evaluation. For example, at the administrative level, policy makers require information to help them decide if a programme should be continued or terminated. They therefore would be more interested in the overall effectiveness of the programme. On the other hand, programme staff need information to help them improve the programme. They would be more concerned about the differential effects of different activities of a programme. Only with a good understanding of the purpose of the study and the identification of interested groups can evaluators most effectively design an evaluation to satisfy the expectations of their audiences.

Selecting Evaluative Questions

Selecting and formulating appropriate questions are crucial in an evaluation for they can help evaluators to focus in the inquiring process. Well-crafted questions would enhance the study to obtain credible information for the audience. However, with so many options available evaluators have to decide which aspects to pursue. Worthen and Sanders (1987) propose that evaluators can solicit views from the stakeholders, resort to past evaluations of similar programmes to determine the issues that have not been settled, review different evaluation models, consider relevant current educational issues or exercise professional judgment as a source to generate questions. Weiss (1998) suggests that priority should be given to

those questions which will yield findings that are to be used. She also points out that questions need to be practical and should be set within the limits of resources. All of these suggestions are potential sources for questions. However, each evaluation situation is different, evaluators have to understand the characteristics of individual programme in order to develop good questions for the study.

Quantitative or Qualitative Evaluation

Quantitative and qualitative approaches can be viewed as categories of designs or more precisely, different types of data (Lynch, 1983). Quantitative evaluation often employs standardized instruments to collect data in the form of numbers. Control or comparison groups are usually incorporated into the study. Statistical techniques are used to analyze the relationship among variables and the findings are expressed largely in terms of statistical significance and/or Effect Sizes.

Quantitative methods are particularly useful in providing specific answers about outcome measures. Their experimental approach can provide strong evidence to support the credibility of the findings and their precision allows investigators to reach conclusions with a higher degree of confidence.

Carefully conducted qualitative studies in the Illuminative tradition have the advantage of uncovering process information. They can provide more vivid and deep data which illuminate the daily actions of individuals. Themes, concepts and trends would then be extracted from this mass database.

Nevertheless, qualitative data can be criticized as being subjective, since the method would have involved an extensive personal judgment of the evaluator and people are concerned about the issues of validity and reliability. However, these issues can be addressed by triangulation and respondent validation. (Ziebland & Wright, 1997; Gubas & Lincoln, 2000)

Each approach has its own strengths. They are not mutually exclusive, in fact, they are complementary. Evaluators may choose to use one or combine both approaches within a study as long as the core issues of the inquiry are addressed with the most effective method.

Outcome versus Process Evaluation

Evaluations are concerned with whether or not programmes are achieving their goals and the accomplishments of these goals are reflected in the outcomes. An essential requirement for outcome measures is to have clearly stated goals which are guided by specific set of pre-defined criteria. When these goals are translated into operational terms, they can be measured by various techniques such as interviews, questionnaires, observations, clinical trials and so on. In order to determine the degree of success or the effectiveness of a programme, some comparisons have to be made.

According to Berk and Rossi (2000), effectiveness has three meanings: marginal effectiveness is the results of different levels of an intervention; relative effectiveness is the consequences due to the presence or absence of a programme; and cost-effectiveness is the comparison of cost per unit of outcome.

The extent to which a programme has achieved its goals can be compared to past evaluations with similar outcome measures. In addition to the desired goals, a programme may produce unanticipated outcomes. Thorough examination of all possible outcomes in advance and to remain flexible and open during an evaluation to allow emergence of results would enhance the success of an evaluation (Weiss, 1998).

Often outcome measures alone are insufficient to allow judgment on the success or failure of a programme. Evaluators need to know how the programme operates before they could draw any conclusions about a programme. There may be other times that evaluators want to find out factors that lead to certain outcomes. In these situations, process evaluations would be warranted. Process variables can be developed empirically at the outset of an evaluation or they may be adopted from established performance indicators particularly in the assessment of professional performance. For example, 'standards of practice for occupational therapy' published by the American Occupational Therapy Association.

Ethical Issues

An important aspect that should not be overlooked is ethical practices. Evaluators have to consider ethical issues at all phases of an evaluation and to assure that all protocols are being followed. The Joint Committee on Standards for Educational Evaluation (1994) has published standards for evaluation studies such as: respondents should be provided with clear information on the purposes and nature of the study to allow them to decide freely if they would participate in the study; all information collected should be kept with strict confidence and only be accessible by the evaluation team to protect the rights and interest of participants; results of individual participants should not be revealed in the report so as to ensure anonymity of individuals. Evaluation results may have consequences for the participants, hence, data should be reviewed critically for appropriateness of releasing.

Validity

In measurement, there are four aspects of quality: face validity; construct validity, criterion validity; and content validity (Jenkinson and McGee, 1997). There are methods for assessing validity and ways to assure measures are developed to measure what they are supposed to measure.

In evaluation, validity refers to a set of criteria for judging the credibility of a study. Cook and Campbell (1979) describe two kinds of validity. Internal validity is concerned with the causal relationship between programme inputs and programme outcomes. For example, the causal effect of problem-based learning might be enhancement of students' critical thinking, which means problem-based learning has been inferred as the factor responsible for enhancement of students' critical thinking. The second type of validity is external validity or generalizability. It refers to the relevance of findings to other subjects or other programmes, and is concerned if these findings could be applied to other settings of similar type.

Quality in education is clearly linked to the process and involves a desire for improvement. Evaluation when built into the dynamic and complex system of education can become a powerful tool for education improvement.

Chapter 2 Clinical Education

In the heart of all allied health programmes there is the core component of clinical education. Although there are some discrete differences, they all share common issues in clinical teaching. The author attempts to review the literature from the perspectives of various disciplines including medicine, nursing, physiotherapy as well as biomedical science in relation to these issues. The author first introduces to the audience the goals of clinical education, which is followed by a brief discussion on the relationship between knowledge, skills and attitudes. Then concepts of theory and practice are considered, issues related to clinical teaching and learning including clinical environment, role of the clinical teachers, strategies in clinical teaching, and learning approach are reviewed. All of these will form the framework for subsequent discussions on the evaluation of the clinical training programme of this research.

Clinical Education

Clinical education is an essential and irreplaceable component in all allied health curricula to prepare graduates for their professional roles (Williams and Webb, 1994). Students are placed in a clinical setting for a specified period where they are exposed to the real world of professional practice. Clinical activities enable students to integrate the theoretical and technical elements of the curricula, to synthesize and transfer previously learned knowledge into practice. It is through clinical experiences that students develop confidence (Lofmark and Wikblad, 2001), critical-thinking, skills in decision-making and problem-solving. By engaging in the real working environment, students learn to participate in team work and to establish interpersonal relationship with members of other health disciplines. By interacting with clients and patients, students develop their sense of commitment and professionalism. It is in the clinical setting that students learn to be active, independent and self-directed learners.

O'Connor (2001) maintains that the goals of clinical nursing education are: to enable students to translate theory into practice; through the use of critical thinking skills to identify and resolve patient care problems; to develop

communication skills; to acquire a holistic view of health care delivery and to develop proper attitude in nursing actions.

In a survey of allied health professional education programme, Higgs et al (1991) developed a list of goals including the knowledge of the discipline; understanding of the health and the health care systems; clinical competences such as clinical reasoning and interpersonal skills; professional accountability; development of personal and professional attitudes and values; monitoring of an individual's own performance and standard; skills for life long learning and self management; the ability of responding to changing health care needs; and development of relationship with other health care teams. They discovered that in addition to the essential knowledge and clinical skills, changes in the health care delivery systems had greatly influenced the demand for an increasing development of generic skills. Consensus on the importance of these goals was also obtained in another study among 54 deans and programme directors of the departments of Clinical Laboratory Science (CLS). They have emphasized that CLS graduates are expected not only to be competent in the practice of their discipline, but also to be competent in human relationship skills, communication, critical and analytical thinking, professionalism and adaptability to change (Elder, Nick and Fowler, 1997). These views are echoed by CLS graduates that in addition to theory and technical competences, professional ethics, communication skills and integrative competences are very important for practice and should be strengthened (Beck, 1994). Among other allied health professions, academic and clinical physiotherapy educators also have developed a position to focus on generic skills over professional-specific skills (Cross, 1998).

With the knowledge explosion, the impact of new technology, the changing patterns in health care delivery and constraints in resources, allied health clinical programmes must prepare graduates not only with the necessary professional specific knowledge and clinical skills but also with a range of generally applicable competence to fulfill the needs of their professional practice.

From Theory to Practice

For decades, theory and practice were looked upon as two separate entities in allied health education. Often students viewed clinical learning as an opportunity only to master techniques and learn to be proficient in technical skills, while some clinical instructors focused only on drilling students to be exacting masters on traditional procedures (Cross, 1994). Some programmes would consider clinical practicum as a supplementary component of the curricula. However, Stengelhofen (1993) brings in an alternative view. She thinks that academic achievement and clinical practice are closely related, since professional practice involves not only sound technical skills but also requires a high level of intellectual functions. What underlines the action encompasses analysis of the problem, decision on what has to be done and the evaluation of the consequence of the approach. Hence, practice is the result of a conscious choice derived from a knowledge base. Gormley (1997) argues that simply practicing skills is meaningless; learning can only be promoted through reflection of the unique experience on why the skill is applied. Argyris and Schon (1974) explains the meaning of their 'espoused theory' as what we claim to do we do, and if we cannot apply what we say into practice, then the theory has not been learned to its fullest sense. Furthermore, in their 'theory-in-use', they suggest that what we actually do is largely mediated through our experience, and in professional preparation, clinical learning could provide us with this experience. Therefore, theory and practice should be viewed as a continuum complementing with each other in clinical education. To make use of such practice-based, 'situated learning approach' (Lave and Wenger, 1991) different levels of professional skills can be developed through various stages, progressing from peripheral participation in the beginning, gradually, over time, towards total responsibility at the end.

It is during clinical attachment that abstract theory becomes concrete evidence, when students start to make connection between what is said in the text books and what is presented in the 'real' case. Working in the real situation enables students to embark on the critical thinking process to identify problem, to search through previously learned theory and principles and apply this knowledge to practice. This is the development of professional competence.

Knowledge Skills and Attitudes

In 1980, the General Medical Council, UK (GMC) recommended 'knowledge, skills and attitudes' as the basis for medical education (GMC, 1980). These three elements are generally recognized by all allied health professions to be the core of their education. Understanding what knowledge, skills and values are required in the practice of the profession and how they interact with each other enables us to design a curriculum to better prepare students to become competent practitioners. Stengelhofen (1993) proposes a model of practice in which she placed these elements at different levels. At the very top are the observable activities, the techniques and procedures undertaken by the practitioners. Supporting these activities are two subdivisions of knowledge, the explicit and tacit knowledge. Finally at the base are the attitudes to work. This model suggests that professional competency is achieved through gradual integration of knowledge, skills and attitudes. Students bring into the clinic with fragmented theories and principles – the explicit knowledge which needs to be explored and built on. Through experiential learning, this knowledge is applied to practice, thus developing tacit knowledge (McAllister et al, 1997). The beliefs, values and attitudes at the deepest level form the core of professional competence become the driving force for effective practice (Stengelhofen, 1993). Therefore, professional practice is more than what it appears on the surface, and it is derived from the values deep inside an individual (Fish and Twinn, 1997).

Knowledge, skills and attitudes are the learning outcomes that are necessary for competent professional practice (Gaberson and Oermann, 1999). The development of clinical knowledge involves critical thinking, problem solving and decision making. Real cases encountered by the students in clinical areas are usually complex. Based on the knowledge they acquired in the classroom and the information collected from the patients, students need to critically analyze and assess the problem, to interpret the situation, and to decide on the best alternative to be used to address the problems identified. To furnish students with a sound knowledge base and appropriate theories that could be applied to practice, course content should include theories pertaining to specific discipline practice. To develop students' clinical knowledge, critical thinking, problem solving and decision-making capabilities, ample hands-on opportunities should be incorporated

into clinical learning (Stengelhofen, 1993).

Various skills are required for clinical practice, however, technical skill is usually the one that receives the most attention. Practice makes perfect. If students were to learn to practice effectively and efficiently, abundant opportunities for performance of skills should be provided to students. It is when techniques are so well-mastered and becoming part of a routine that students can focus on the 'whole picture' and exercise their critical thinking process (O'Connor, 2001). Nonetheless, technical skills mastering should not be over-emphasized, otherwise, we will 'only produce good but unthinking technicians into the field' (Stengelhofen, 1993:15).

The competent clinician requires more than just technical expertise. To respond to the needs of the patients, practitioners need high level of knowledge, technical skills and desirable attitudes. Health care personnel are expected to behave and act on certain value. Highly regarded values such as commitment to patient care, compassion, integrity and confidentiality are pledged in the Oath of Hippocrates of the medical profession. Besides these humanistic and ethical dimensions, clinical education should also promote life-long learning to enhance continued professional development. It is through professional socialization that practitioners internalize those values and beliefs they honor to uphold their responsibility and moral obligation to their clients, to the society and to self (Gaberson and Oermann, 1999). However, there are recent concerns on the gradual erosion of the development of the caring, dedication and other professional attributes in the medical profession (Ludmerer, 1999). Questions were raised as to whether these values are being developed in students. (Stern, 1998).

Clinical education is important in the development of professional practice. Educators need to design a well-structured programme to include a wide range of subject disciplines to provide the knowledge base and to allow ample practice opportunity to prepare students for professional work.

Issues

There are many factors that may influence the quality of clinical education, e.g., the learning environment, the characteristics of the teacher and student, the

nature of clinical practice, the teaching and learning approach and assessment methods may all well influence clinical education. The following is an attempt to review some of these issues in clinical education.

The clinical environment

Clinical education is unique and is very different from classroom education. There is a sharp distinction between the mission of the health care facility and the academic institution. The hospital is organized around patient care, attention to patients' welfare must take priority, and teaching is only secondary to that service (Watts, 1990). With increasing service pressure, the clinical educator, who is often a member of the clinical team, may not be able to devote the optimum amount of time to teaching (Fox, 1999), thus leading to a feeling of loss on the student as well as stress on the clinician. The clinical environment is a rich source for clinical learning, however, it is complex and unpredictable. Although it provides access to patients for students learning, it may not be able to provide the same specific clinical case included in the syllabus at all times. Hence, even students rotating through the same discipline may gain different clinical experience. Furthermore, every patient's problem is unique, and the pace of teaching and learning has to follow the changing condition of the patient. Students may need to adjust to this type of variable. From time to time, clinicians from different disciplines may compete for access of a patient, for example, when a physiotherapist wishes to introduce a therapy to a student, a radiographer may also come along for the same patient, since the doctor has ordered an X-ray to be taken. This could interrupt the learning plan of the student. The recent practice of reduction in hospital stay for in-patients may result in less patient contact and incomplete follow-up on patient care learning. The expansion of allied health programmes has led to the use of more clinical sites including hospitals, nursing homes, and hospices, for students' placement. This is beneficial on the one hand, since students are exposed to various types of cases, it also has created some controversies. Educators are concerned about the variability in the clinical experience of the students, and this is especially true for the recent dramatic use of ambulatory care sites for medical education (Whitcomb and Anderson, 1999). In addition, utilizing so many different sites makes coordination even more difficult.

Teaching and Learning

Teaching is a complex process involving interaction between teacher and student. Its main function is to facilitate learning. Teaching is not simply passive information delivery or skill demonstration, rather, teaching is to involve student to actively acquire, explore and develop knowledge and skills. Through careful planning of activities and instructions, students are guided to develop autonomy and self-direction to master their own learning.

To be effective in teaching, clinical teachers need to have a good understanding of the students' knowledge background and needs, the subject matter, general principles of teaching and learning and different modes of teaching (Irby, 1994). While students entering the placement are pursuing the same objectives, they may vary in their learning needs. Knowing the academic levels and needs of the students enables teachers to select and design clinical activities that could build on their existing knowledge to help students to further expand their learning (O'Connor, 2001). An understanding of how students learn and the methods of teaching allow teachers to choose the most appropriate teaching approach to foster students' learning.

Since independent learning and autonomy are the broader goals in clinical education, most clinical educators advocate adult learning. Adults, who have had wider life experiences, learn differently from children (Havelock, 1995). They tend to learn according to their own agenda, in terms of styles, pace, time and purpose. Adults tend to seek education that is perceived to be relevant and have practical use for their daily lives (McAllister et al 1997) and learn by connecting the content to be learned to what is already known. Adults regarding themselves as learners tend to take up more responsibility and self-directedness in their learning (Knowles, 1980). Problem-based learning is a valuable strategy used in clinical education to promote self-directed learning (Hewitt-Taylor, 2002; O'Connor, 2001). McAllister et al (1997) argues that clinical education which is experiential by nature, provides real patient cases for problem solving is a unique opportunity for adult learning, However, the McAllister group cautions that students cannot have total independence or autonomy for they have both legal and ethical responsibilities towards the patient. It is only when students become more mature as they progress

that more freedom could be allowed.

Role of Clinical Educator

The role of the clinical educator is multifaceted with many responsibilities. The clinical educator may serve as a teacher, an administrator -manager, a role model and a clinician.

Teacher - The teacher is a facilitator of learning who needs to plan and organize learning experience with reference to the learning objectives of the activities and the needs of the students. The teacher provides instructions, resources, guidance support and encouragement to foster students in the development of knowledge, skills and values. In addition, it is the role of the clinical teacher to objectively evaluate students' performance. However, a good practitioner is not necessarily a good teacher. Many clinical teachers assume the teaching role without any formal preparation with few believing that teaching is a natural skill (Neville and French, 1991). Since competent teaching is found to be a major factor influencing the quality of clinical education, there is increasing recognition of the need for training practitioners as educators. Many allied health professions are now recommending a structured teaching programme to be developed for clinical teachers (Neville and French, 1991; Lee, 1996; and Hesketh, et al, 2001).

Administrator-manager – In the administrative role, clinical educator must ensure adequate practice opportunity and an environment conducive to clinical learning.

Role model – The attitudes and behaviors of the clinical teacher may have an immense influence on students. It is the warmth and empathy shown while caring for patients, the calmness presented while managing crisis and the respect displayed while discussing with students that students remember the most on their teachers. Modeling professional behavior is the most powerful strategy in shaping students' conducts and values (Whitcomb, 1999; Bordley and Litzelman, 2000).

Clinician – Most clinical educators are also practitioners who attend to patient service. Clinical educators have to ensure quality care for the patients as

well as to provide a safe environment for students' clinical learning. This dual role has been a long-standing conflict between education and service needs and has resulted in enormous frustration in clinical educator. This issue has yet to be addressed (Lee, 1996).

The Academic Tutor

In many allied health education programmes, for example, nursing, speech pathology, radiography and biomedical science, clinical teaching is carried out by clinical practitioners and not by faculty members. This is particularly true for programmes offered by the university which has no direct affiliation to a clinical facility. Academic members assume the responsibility of coordinating the programmes, to liaise with the placement agency, maintaining a link between the programme and students, and to ensure that all students have achieved the training objectives (Nehls et al. 1997). The faculty member will not be involved in the actual on-site teaching, however, regular visits to the clinical settings can support students, provide opportunity for discussions with students on any problems they have, to establish contacts with the clinical staff, to communicate with clinical teachers on the development of the students and the programme, to facilitate feedback and goal setting and to act as resource person (Stengelhofen, 1993). Clinical visit is an effective way to bridge the cultural differences and to promote collaboration between service and the university (Sutton, 1996), and should be treated as an important issue. Maintaining close communication and collaboration between the tertiary sector and the health care facility enable students to achieve optimum learning outcomes (Dunn and Hansford, 1997).

To facilitate learning, every clinical teacher has to be aware of those factors that promote or impede learning in the clinical setting. Watts (1990) discusses four ingredients which she thinks are of importance: motivation, information, practice and feedback.

Motivation

Clinical teachers may encounter students who are unmotivated and show no interest in learning, however, their enthusiasm can be promoted through different

strategies and at different levels. There are different forces that drive people to achieve what they value. Need satisfaction, personality characteristics and personal development are identified as important factors. It is often the intuition to care and to cure that leads people into the health care professions, the desire to further develop in their profession that makes people to join continue education programmes. In school, assessment is a powerful motivation for students to learn. Williams (1999) supports the findings that autonomous motivation for learning where effort is derived from a person's inner self promotes higher quality learning and better academic outcomes, while controlled motivation with influence stemming from outside would lead to short-lived and rote learning. He also concludes that an autonomous supportive climate provided by the clinical educators could motivate medical students to become more persistent in their learning and practice endeavors. Mann (1999:239) proposes that to improve motivation it is desirable to comprehend students' perception on values, behaviors and rewards; to provide regular feedback on students' performance; to ensure a constructive alignment between programme goals and assessment; to encourage practice to promote confidence; to provide a supportive and rewarding learning environment; to employ various enhancing teaching methods such as problem-based and experiential learning.

Clinical teachers play a central role in clinical education. Some practitioners assume the role of clinical teachers because they are interested in teaching. Some may feel it is their professional responsibility, some perceive it as a path to career advancement and some undertake the position due to pressure from the department. Whatever the driving force, a combination of both intrinsic and extrinsic rewards will better motivate clinical teachers to participate in the programme. Clinical teachers must be offered recognition and support for their educational contributions and efforts (Sachdeva, 2000). However, clinical teachers are often dissatisfied and frustrated by the enormous administrative workload, conflict between service and education needs, staff shortage, poor relationships, (McHale, 1991), lack of preparation for their teaching role, as well as time constraints (Clifford, 1992). Unless these issues are addressed, clinical teachers will not approach teaching positively.

Information

In Watts' view (1990), it is the content, nature and the methods of dissemination of knowledge to students that are of importance. To facilitate students to secure knowledge, teachers should select topics relevant to students' practice and to adopt an appropriate teaching approach to guide students' learning.

O'Connor (2001) argues that it is also important that clinical teachers have a clear understanding of the objectives of the clinical education programme and its place relevant to the entire curriculum. A knowledge of what has been taught in the classroom and the level of competence of students could help clinical teachers to establish a realistic starting point for planning students' clinical experience and a reasonable expectation on students' performance (Eaton and Cottrell, 1998). Course document and communications with the academic department could provide the necessary information.

Practice

The purpose of clinical education is to provide experiential opportunities to enable students to integrate theory and practice in the development of critical thinking, technical skills and attitudes necessary for professional practice. Technical competence can only be achieved by actual performance of the tasks. It is through mistakes and success during practice that students gain confidence to performing complex procedures (Grealish and Carroll, 1998).

Effective teachers need to be technically competent themselves to guide students in their practice. They should be familiar with the operation of the clinical unit so that activities planned would cause the least disruption to patient care (O'Connor, 2001). For each new technique, teacher will first explain the principle then follow by demonstration of the procedure, and students will replicate a similar performance. Because technical skills have become so routine, it is easy for teachers to discount what seems to be trivial steps for them but important for students. At times, the "short cuts" taken by the teachers in performing a procedure may create confusion in the students, as they deviate from what has been taught in the classroom. It is essential for the teachers to stay with the students during the

entire procedure without taking over for the students unless there is clear danger on patients' safety. Taking over interrupts students' learning and may impede the growing confidence (O'Connor, 2001). Teachers should observe while students work through the procedures, giving prompts and encouragement when appropriate during the process, and providing feedback to students to what could be improved after the completion of the task.

Opportunities to practice are especially valuable to students, however, recent researches have indicated that there is inadequate provision of this opportunity (Corkhill, 1998; Lofmark and Wikblad, 2001; Risenberg, Biddle and Erney, 2001). The duration spent in clinical areas does not determine success in technical competence unless students are given the opportunity to practice. Although Neary (1997) argues that college laboratory could provide a good training ground for students' practice, most students think otherwise (Corkhill, 1998).

Feedback

To master clinical skills requires repeated practice and refinement during the course. However, without feedback or reinforcement, change in performance will be little. Constructive feedback have consistently been rated highly by students of various professions as a feature of good clinical experience (Neville & French, 1991; Lofmark & Wikblad, 2001; Barnard, 2001) and regard it as an effective way of helping them to progress towards clinical competence. There is also good evidence for the very positive impact in classroom settings (Black and Williams, 1998).

Feedback reinforces not only technical skills but also knowledge and attitudes. It offers information to students as to whether she is on the right track or how far her behaviors matched with expected outcomes. Feedback should acknowledge both strengths and weaknesses. When addressing deficient performance, teachers should clarify points that are not clear, explain to students what is wrong, why it is wrong and how it can be corrected. Ideally feedback should be immediate, however, when to provide feedback is dependent on clinical situation and the judgment of the clinical teacher. Feedback should not be judgmental and should focus on the behavior and its effects (Barnard, 2001). Teachers should bear

in mind not to degrade students and to spare them from humiliation. Therefore feedback should be specific and objective. Furthermore, it is important to provide feedback based on evidence (Fitz-Gibbon, 1996), for misinformation may impede learning and students' confidence. Although it is the responsibility of the teachers to provide feedback, students should be encouraged to reflect on his own actions and be self-critical (Stengelhofen, 1993). In addition, feedback should not be a one-way process with only students receiving feedback from the teachers. Students should have the opportunity to express their concerns, fears, and needs which can help teachers to improve their teaching.

Interpersonal and communication skills

How teachers interact with students seems important from the students' perspective. Hence, it is not surprised that interpersonal and communication skills have appeared in many publications as the most valued characteristics of clinical educators (Neville and French, 1991; Jarski, 1990., Krichbaum, 1994). Desirable attributes for clinical teachers such as friendly, helpful, forthcoming with information and approachable are welcome by the students (Neville and French, 1991). A good personal relationship between teachers and students could promote learning. Havelock (1995) suggests that an effective 'trainer-trainee' relationship requires self-awareness; honesty and openness; mutual respect; sharing each other's values and goals; and being useful to each other.

A study by Colliver (1999) has demonstrated that clinical competence is moderately related to the interpersonal and communication skills. Communication is a complex process which conveys meanings, ideas, and information by means of verbal and non-verbal message systems (Pickering, 1987). However, the message sent need not necessarily be the message received. This can create problems in understanding feedback from the clinical teachers. Lingard and Haber (1999) propose the use of the rhetoric approach, a method which can capture the relationship between intentions, contents and effects, to analyze the discourse to ensure information are shared. Since students may not be able to relate the goals underlying each assigned case, or the feedback provided, it is essential for clinical teachers to communicate clearly to students what are the objectives of the clinical experience and what are the expectations from students. Direct and structured

communication could facilitate clinical teachers to convey directions and clarify views. Communication can also be a mechanism to assist students to 'professional socialization', a 'hidden curriculum' as described by some authors (McAllister, 1997). Through discussion, teachers can introduce to students various aspects of professionalism such as ethical issues, professional conducts, values and attitudes, to foster their development as practicing professionals.

Assessment

Assessment is an important component in the learning process and has profound influence on the way students learn. Assessment serves many purposes. One major purpose is to provide evidence that objectives have been achieved and competence developed (Oermann and Gaberson, 1998). This is the summative assessment and is usually administered at the completion of a programme. A second purpose is the need to ascertain that students have met the standard of professional bodies and graduates are competent to practice. Through formative assessment, teachers monitor students' progress, provide feedback of their strengths and weakness, identify learning needs and to plan future learning experience. Feedback from assessment can provide reinforcement for students learning and examination scores can be used as predictors for students' potential development. Furthermore, assessment can help to judge the effectiveness of the teaching or the programme which form the basis for improvement (Stone, 1998).

As discussed earlier, the core elements of professional practice, skills, knowledge and attitudes are inter-related (Stengelhofen, 1993). To prove that students are professionally competent, the assessment has to demonstrate that all three components have been adequately acquired. Although it is simple to assess skills as it is readily visible and knowledge through various formats such as paper and pencil test, it is difficult to define attitudes because it is an elusive concept and there is little agreement on the attributes to be measured (Joorabchi and Devries, 1996).

The assessment of clinical competence is a complex procedure and has provided educators with problems of objectivity, validity and reliability (Giro, 1993). Many methods are available for assessing clinical competence including

rating scale, case study, journal, self-assessment and others. Each appears to have advantages and disadvantages. Since graduates from different universities would enter the same practicing profession, it is essential to ensure parity of standard among them. Both norm-referenced and criterion-referenced methods are proposed for assessing students. However, the norm-referenced assessment which aims to compare the performance of a student in relation to other students was being criticized as lack of a standard which makes comparison of students across institution unrealistic (Harris and Bell, 1994). Although the criterion-referenced method appears to be more appropriate, as it assesses students by comparison with a set of pre-determined criteria, it may be difficult to establish consensus on the criteria to be measured among universities and professions (Stengelhofen, 1993). Besides, it is described as “task oriented, didactic and pedagogical in nature, and does not fit well into the contemporary styles of nurse education” (Chambers, 1998: 206). The proposal of assessing reflective practice which deems to be valuable in the development of critical thinking was met by questions of the credibility of the research tools (Wong, 1995). The objective structured clinical examination (OSCE) is a competency-based assessment advocated by many educators. It makes use of structured multistations to measure clinical skills, attitudes and cognitive objectives while students are being observed. The inter-rater agreement as a source of error and perhaps of bias of this type of assessment is a major concern, however, good inter-rater reliability can be achieved with a well-structured checklist (Bullock, et al. 1999). Nonetheless, if contents incorporated into the instructional programme do not follow that of the stated goals, assessment would not be valid (Joorabchi, 1996).

No single assessment is ideal for all situations, educators should therefore strike a balance among validity, reliability, practicability as well as cost effectiveness of an assessment approach.

Clinical learning

Learning is a process through which people change as a result of their experiences. This may involve changes in people’s behavior, beliefs and perception which is greatly influenced by an individual’s learning approach.

Examining ways that students approach learning can help clinical educators to understand the problems student experience, to explore the practical implications, and to develop strategies to meet students' needs. A learning style is perceived as a 'typical performance spontaneously demonstrated without conscious awareness or choice across a wide variety of situations with similar requirements' (Curry, 1999: 409). Marton and Saljo (1984) identified two approaches to learning in students: the deep and surface approach. The surface learners tend to focus on discrete facts from the text, memorize information and reproduce superficial knowledge. These learners are mainly concerned with passing an assessment and are passive in their learning. Contrasting to the surface approach, deep learners actively seek to understand the underlying meaning of the content, drawing on previous knowledge and experience to make sense of new ideas and relating evidence to conclusions (Entwistle and Ramsden, 1983). It has been found that factual overload is a major factor leading to the adoption of a surface approach in learning by medical students, particularly of the younger age group (Newble and Clarke, 1986; Aaron and Skakun, 1999).

Another approach to studying was later identified by Entwistle and Waterson (1988) - the strategic approach. Students, largely motivated by achievement, in a well-organized manner choose to study only elected topics which they think will be in the examination. Strategic learning tend to be short-lived and difficult to recall for later use. In allied health education, theory learning phase often precede that of the clinical practicum, Cole (1990) suggests that an elaborated approach is most effective in integrating information of one subject to another, helping students to see how these information fit together in an applied setting. Curriculum structure such as the use of problem based learning can provide opportunities for elaboration where students can integrate knowledge from various subject disciplines to solve the problem presented. However, the effectiveness of PBL remains a subject of debate. While some studies found the PBL experience rewarding (Richardson and Trudeau, 2003), with students achieving superior national examination scores than students who completed traditional curricula (Blake et al, 2000), a recent review casted some doubts over the approach (Newman, 2003).

Honey and Mumford (1986) developed a questionnaire which reveals different ways people approach their learning and had grouped the characteristics of these individuals under four categories: activist, reflector, theorist and pragmatist. An activist is enthusiastic about new challenges and learns by active experimentation. A reflector learns by gathering information from different sources, reflecting on the experience before drawing on any conclusion. A theorist analyzes and integrates observations into theories, attempting to build a holistic view from different information. A pragmatist chooses to try out new ideas, theories, and techniques and is interested in practical results. In a dynamic environment such as the clinical setting, students are faced with different types of cases. Each case has its uniqueness and requires different treatment. The way an individual tackles the problem varies and may be dependent on their learning approach. Therefore it is important for clinical teachers to recognize students' learning styles, so that they can be more sensitive to the different learning behaviors displayed by the students and help them to cope with the demand of the clinical education (McAllister et al 1997). For those students having difficulties in meeting the learning objectives, clinical teachers can respond by modifying the task to match students' learning styles or to encourage students to adopt new learning strategies (Curry, 1999).

Furthermore, an understanding of their learning profiles enables students to develop their own learning strategies and effective study skills to adapt to different situations. It is the responsibility of the students to take an active part to master their own learning.

Other Issues

Anxiety

It is only normal that students are a little apprehensive as they approach the clinical learning situation. Students worry about their relationship with the clinical teachers; whether they will be provided with learning opportunities or if they can handle distressing situation such as attending an autopsy. Students are concerned whether they can cope when working in a 'threatening' environment like the psychiatric ward and if their skills and knowledge are adequately prepared to meet patients' needs. Biomedical science students worry if they would contract HIV or

infected by hepatitis during specimens processing (Ioannidis and Kwan, 1995). However, the fear of a mistake in harming a patient and making his condition worse has caused the highest level of anxiety in health science students (Kleehammer et al, 1990; Moss and McManus, 1992). A mild level of stress can enhance learning, however, an excessive level can inhibit students' performance (Mitchell and Kampfe, 1990). It would be helpful if students are provided with information of the clinic or hospital before placement, so that they can better prepare themselves. Clinical teachers could help students to bring these concerns to open discussions to alleviate these anxieties.

Clinical teachers are challenged with similar anxieties. The fear of students harming a patient during their learning is apparent. Hence, clinical teachers should have a clear understanding of the level of competence of the students before assigning a task and to fill in any gaps of knowledge as appropriate so as to ensure a meaningful learning experience for the students and safety for the patient. A trusting relationship between teachers and students could enable students to be more relaxed and be more confident in their practice. In addition, clinical teachers are anxious about their knowledge base or if they are kept abreast of the latest information on clinical practice. University could therefore support them by organizing seminars and workshop.

Ethical Issues

It is the responsibility of clinical teachers to protect the rights of both patients and students. However, sometimes these interests are in conflict, thus creating ethical dilemmas for the teachers (McAllister, 1997). For example, while ensuring the practice opportunities of students, clinical teachers have to assure the safety of the patients. Hence, students should not be assigned to perform a particular procedure alone unless there is supervision or she has shown to be competent in performing the task. It would also be a tough decision for the student if a patient requests that his personal information not to be released to the clinical instructor, this would raise the issue to whom is the student ethically responsible. During clinical learning, it is inevitable that students would encounter such issues as life and death. There are times when all medical treatment fail that the issue of quality of life becomes apparent. The doctor may have to seek consent from the

patient not to provide active therapy but to offer palliative care to reduce the suffering of the patient (Clark, 2001). End-of-life decision rests on values and morality and differs between individuals. Teachers have to help students to identify the principles and values involved to enable students to develop their ethical standards.

A quality clinical placement programme arises from sound education fundamentals. It is important to recognize the problematic nature of professional practice, to have an open mind to embrace the potential issues and be ready to meet the challenge and to provide continue efforts to refine the practice (Fish and Twinn, 1997). The above discussions would be used as a guide for the evaluation of the clinical training component of the Biomedical Science programme for this thesis.

Chapter 3 Methods

The Programme

With an increasing demand on greater transparency and public accountability, concerns about standard and quality on teaching and learning have become the centre stage in higher education. Each year, the second year biomedical science students of the Hong Kong Polytechnic University are placed at the pathology laboratories of different hospitals of various types for clinical attachment. These hospitals include large public teaching medical centres, government subsidised hospitals, polyclinics and small private hospitals. Students have to spend a total of 12 weeks rotating through the disciplines of Clinical Chemistry, Medical Microbiology, Haematology and Histopathology, each for a period of three weeks. For each discipline rotation, students are assigned to different sections of the laboratory to learn various techniques and procedures under the supervision of a clinical laboratory technologist. Since there are many sections in each laboratory, a great number of technologists are involved in teaching the students.

A student handbook with clear objectives and a list of tasks to be completed in the training is provided for students at the beginning of the programme. The overall objectives of the field training are to develop confidence in the students so that they can participate fully in team work; to develop the essential skills of safe laboratory practice and to develop professional and personal qualities (The Field Training handbook, 2000). The field training programme is divided into five sub-modules, I-V. Students' clinical performance on the sub-modules I-IV is to be evaluated by clinical staff at the end of each rotation on a pass/fail basis. When students return to the university, they have to complete a work assignment based on their clinical experience and to sit for an oral test. These two elements are to be assessed by the university staff and the grade obtained for this sub-module V will contribute to the Grade Point Average (GPA) calculation of the student.

There is no formal contract between the university and the servicing sector, all participating hospitals have undertaken the training programme in good faith, as a professional commitment for training the future work force. A field training

programme committee, comprising representatives from the training facilities and the university academics is responsible for planning and developing the training programme. The training centres are not an integral part of the university and each hospital is administratively independent. The organization of the clinical training programme may differ among centres for example, some hospitals may elect to assign one member of the clinical laboratory staff to guide students' learning while others may involve a few teachers in each section as mentors to students.

Since 1998, on a voluntary basis, the Hospital Authority has undergone a re-engineering exercise of its laboratories. Compounded by the severe economic downturn locally, it has frozen the creation of new posts and deployed current employees to new hospitals. As a result, many laboratories have suffered from a shortage of manpower. With increasing service demand on clinical laboratory staff, less time is available for students, and administrative and operational difficulties began to arise. As the coordinator of the clinical training programme of the Biomedical Science curriculum, the researcher had received complaints from students that there were insufficient guidance, supervision and feedback from the clinical instructors. They were most disappointed with the lack of opportunities for actual practical experience on different procedures and testing. On the other hand, clinical instructors had reported that students lacked motivation to learn. It was apparent that these problems had to be tackled as they would affect the effectiveness of the programme and hence the learning outcomes of students. This had prompted the researcher to initiate a study to evaluate the training programme, to find out if objectives of the programme were met, to identify problems in the teaching and learning areas, to generate credible evidence and to develop rational options in improving the effectiveness of this programme. The undertaking of such a project by the researcher had stemmed from a genuine desire to improve student learning and development of the programme. In addition, it is a professional responsibility, a scholarly activity and an opportunity for self-development of a teaching staff. Through the study, it was envisaged that information obtained could be directed back to the students on their needs, to the teaching teams on their teaching practice and to the administration of the department on the change and improvement of the programme. Being a teacher of the programme, the researcher had the advantage of closeness to the subjects, the knowledge of how the programme operates and the familiarity of the learning contexts. It would then be

appropriate for her to pursue a research agenda that could address the issues faced by the programme.

Design of the study

The study was designed as a formative evaluation that aimed to improve the programme by collecting data on the processes and outcomes of the programme and to feed that information back into the system so that the information would have a positive impact on the programme. It took into consideration the guidelines offered by various models reviewed in the earlier chapter on planning and analysis. The study partly adopted an objective-oriented approach (Tyler, 2000) by including test data such as subject grade, grade point average and more general outcomes such as confidence and transfer of knowledge. A large segment of the evaluation incorporated an assessment of the process as in the CIPP model (Stufflebeam, 2001) to identify issues related to the teaching and learning processes.

This study adopted a mixed-method approach. Both quantitative and qualitative methods were used simultaneously to investigate the strengths and weaknesses of the programme. Questionnaires were employed to gather data for statistical analysis to provide detailed information. Open-ended questions within interviews were used as in the naturalistic approach to search for a deeper understanding of the factors affecting the operation and effectiveness of the programme (Parlett, 1977). This multi-methods approach served many purposes. It aimed to triangulate findings (Secker, 1995; Macdonald, 1996) as different modes of inquiry were used to explore the same issues. It aimed to accumulate evidence from a variety of sources, thus adding richness to the context and revealing details in various aspects of the study. In addition, it aimed to complement the strengths and reinforce the results of each method, such that findings generated from the research would be more credible.

The proposed project was carried out in two phases (Fig. 1). In the first stage, all year-two biomedical science students and hospital clinical instructors were invited to respond to two separate questionnaires on the dimensions of clinical learning and teaching, organization of the programme and personal gain. All participants were to join the project on a voluntary basis. Data were collected and

statistical analyses were performed to study students' and instructors' perceptions on the four dimensions. Recommendations to promote student learning were made based on the findings from the first stage.

Interviews were conducted with department managers to seek their views on various domains of the programme. Information collected was used to triangulate findings from the survey. In the second stage, the same survey was carried out on a second cohort and data were again collected and analyzed to determine if improvement had indeed been made.

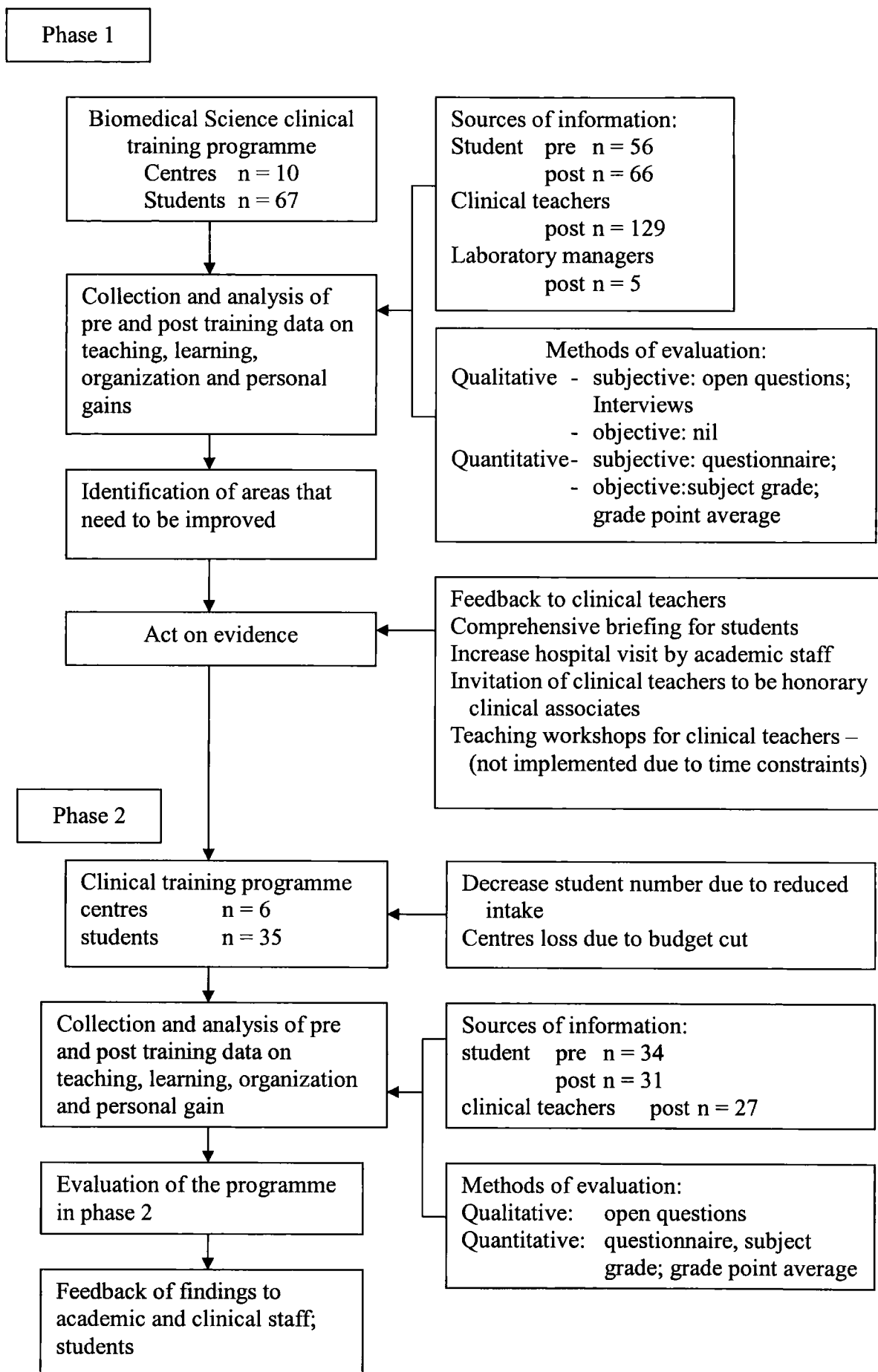


Fig. 1 Flow diagram of an evaluation of a biomedical science clinical training programme

The Instruments

There is an array of instruments available for surveying perceptions of students, however, no single instrument fits all situations, hence the researcher decided to develop instruments that would measure variables pertaining to our programme.

Two questionnaires were developed for the study. The first one was for the assessment of student perceptions on teaching and learning of the programme. The content of the questionnaire was derived partly from the literature on the key factors contributing to the effectiveness of the programme and partly through views of students on what they perceived as good clinical teaching and learning.

A meeting with a group of biomedical science students who had completed their clinical training was held in October 1999. Students were asked to respond to the four open questions presented to them:

1. What factors would affect your clinical experience?
2. In your opinion how do the clinical instructors facilitate your clinical learning?
3. How do your contributions facilitate your own clinical learning?
4. In your opinion what is good clinical training?

Students were asked to write down their opinions based on their clinical experience. Information collected was studied and factors regarded by students to be important to the programme were identified. Based on students' responses and information from literature about factors that would influence the clinical training programme, the first questionnaire was developed. Content was assessed by asking academic colleagues to judge the scope and content of the instrument. All staff agreed that items in the questionnaire could provide useful information for evaluation of students' perceptions on various aims of the clinical training and was shown to have substantive face validity.

The field training questionnaire for students (Appendix A1-pre training and A2-post training) contained twenty items for measuring four different dimensions. Response category was a simple 5 point scale, ranging from strongly agree to strongly disagree.

The first construct aimed to measure the quality of clinical teaching provided by the clinical laboratory staff in terms of their approach and practice in teaching (items 1, 2, 3, 4, 10, 17). The second construct was set to measure learning approaches of students (items 5, 6, 7). The third construct was designed to measure the personal gain of the students from the clinical placement experience (items 11, 13, 14, 15, 18), and finally the fourth construct was designed to measure the organization of the programme (items 8, 9, 12, 16, 19, 20). This questionnaire was trialled on 40 biomedical science graduates and its internal consistency was computed.

The second questionnaire was developed to measure clinical laboratory teachers' perceptions of a quality clinical training programme (Appendix B). The content development was based on three main sources. Firstly, literature on good clinical teaching practice as identified by the medical, nursing, physiotherapy and the biomedical science professions, secondly, live teaching experiences from clinical teachers through informal discussions and meetings, and thirdly, views from university staff with clinical teaching experience were sought. The information gathered was used as a framework for items development. An instrument with twenty items was constructed under the four dimensions of clinical teaching, student learning, clinical teachers' personal gain and organization of the programme. Items 1, 4, 6, 7, 8, 9 and 14 were aimed to measure teaching, items 13, 16, 17 and 20 to measure learning, items 2, 3, 5, 10 and 15 for programme organization and items 11, 12, 18, and 19 for staff personal gain. The questionnaire was reviewed by two academic staff and some rephrasing of the items was recommended. The questionnaire was then piloted on a small group of university clinical teachers prior to the use for the study.

As noted above, these two questionnaires were developed to measure the perspectives of both students and clinical laboratory teachers on issues relating to teaching, learning, organization and personal gain. This was intended to determine

the association of various factors and the effectiveness of the clinical training programme. However, these instruments had their limitations in covering the depth of the related issues. Therefore two open-ended questions were included in the students' post training questionnaire. This would allow students to express more freely on their clinical experiences which may help to clarify responses to the closed questions or unveil matters that are covered in the instrument. Furthermore, interviews with department managers of the pathology services were adopted in the research design to help interpret the results of the quantitative measurements from student and instructor perspectives. Qualitative method is particularly useful for developing an understanding of how the programme operates and interview is a technique commonly used in education and health related research (Jones and Hunter 1995). A list of questions as 'interview guide' (Fielding, 1992) was established (Appendix C) to guide the interviewee to unfold their views to gain insights on the programme and the findings would be used to triangulate results obtained from the questionnaires.

Requirements of measures

Validity and reliability are two important issues to be considered when designing a questionnaire. Validity is concerned with the extent to which an instrument measures what it purports to measure and reliability refers to the extent to which any particular method of data collection is replicable.

In order for the findings to be meaningful, the validity and reliability of the instruments have to be established prior to data collection. Since the contents of both questionnaires (for student and hospital clinical laboratory instructors) were mostly derived from students' and instructors' view points, items in these measures would be representative of the four dimensions they meant to measure. In addition, expert opinions from other staff members of the programme were sought to confirm the validity of the instrument. Internal consistency of items forming the various dimensions of the two questionnaires was assessed by computing Cronbach's alpha on feedback from the two pilot studies (Table 1 – student; Table 2 – instructor).

Table 1 – Internal consistency reliability of the four constructs in the student questionnaire

Scale	Alpha	No. of item	No. of cases
Clinical teaching	0.78	6	40
Student learning	0.60	3	40
Organization of the programme	0.78	6	40
Personal gain of student	0.77	5	40

Table 2 – Internal consistency reliability of the four dimensions in the clinical teacher questionnaire

Scale	Alpha	No. of item	No. of cases
Clinical teaching	0.90	7	6
Student learning	0.81	4	6
Organization of the programme	0.90	5	6
Personal gain of instructor	0.50	4	6

The reliability coefficients for the subscales on both questionnaires ranged from high ($r = 0.90$) to marginal ($r = 0.50$) reflecting that items on a scale were tapping a single underlying construct. Although the reliability coefficients of one of the constructs in each questionnaire was only fair (such as ‘student learning’, $r = 0.60$ in the student questionnaire and ‘personal gain’, $r = 0.50$ in the teacher questionnaire), it was decided to use the instruments for the study after consultation with other teaching colleagues.

The Sample

Ten hospitals took part in the first phase of the study. Four were large acute care regional teaching hospitals, two medium size general hospitals, two government- subsidized hospitals, one small private hospital and one government polyclinic. Only six hospitals participated in the second phase of the evaluation due to two reasons. Firstly, two hospitals withdrew from the training programme due to budget cut and secondly, there were fewer students and they were thus placed at six centres for easier management.

All second year biomedical students from two consecutive cohorts (year 2001, $n = 67$; 2002, $n = 35$) were invited to participate in the study. For cohort one,

56 students returned their pre and 66 completed their post-training questionnaires, yielding response rates of 83.5% and 98.5%. For cohort two, there were 34 completed pre and 31 post training questionnaires with response rates of 97.1% and 88.5%. There were 42 females (63.3%) and 26 males (36.4%) in the first cohort, 15 females (45.4%) and 18 males (55.5%) in the second cohort.

Two hundred and sixty questionnaires were sent to the laboratory managers of ten different hospitals for distribution. One hundred and twenty nine clinical laboratory teachers participated in the survey in 2001. Since the researcher had no information on the exact number of questionnaires being distributed, the response rate was only estimated to be 49%. Although the number of clinical teachers involved in each discipline varied, two colleagues were responsible for coordinating the assignments and monitoring students' progress. Since they better understood the organization of the programme and the performance of the students, it was decided to survey this group of teachers, hence, only 48 questionnaires were sent to the hospital managers for distribution in 2002. Twenty- seven instructors returned the survey questionnaire, with a response rate of 56%. Seventeen participants in this group (63%) had entered the survey the first time. Within the first group of teachers, 85% of the instructors were university graduates of whom 29% had higher degrees. With reference to clinical experience, 28.3% had 3 to 10 years of service, 56% had 11 to 20 years of experience and 15.7% had worked in the laboratory for over 20 years. For the second teacher cohort, 96% had first degree with 41.7% at graduate level. Experience profile was similar to that of the first teacher cohort. Twenty-two percent had 3 to 10 years of service, 55.6% had 11 to 20 years of service and 22.2% had over 20years of experience.

Five department managers (centres 1,3,4,7,9), including two managers from regional teaching hospitals, two from general hospitals and one from a subsidised hospital, representing the various clinical settings where students were placed were interviewed to seek their views on various dimensions of the programme.

Inclusion of all biomedical science students has avoided selection bias, however, the small sample size is a concern. As remarked by Layte and Jenkinson (1997), 'a small sample is unlikely to be representative of the population under investigation, even if it is representative, true differences between subgroups of the

sample may not reach statistical significance'. In addition, as with any survey, it carries the risk of recall bias.

Data collection and data analysis

During the planning phase of the study, letters were sent to the Chief of Service of the department of pathology of 10 different hospitals which offered clinical training programme for biomedical students to seek their support for the research. In January 2001, 67 biomedical science students were placed at 10 different centres. Before they started their clinical rotation, the student feedback questionnaire (Appendix A1) was distributed to these students (cohort 1). The nature of the study was explained to them by the researcher. Students were asked to complete and sign the questionnaire if they were willing to participate in the project and return it immediately to the researcher. Permission to access students' academic results to link up other data was also sought (Appendix D). The same questionnaire (Appendix A2) with two additional open-ended questions was again administered to the same group of student in May 2001, after they had completed their clinical training to further explore students' perceptions on their clinical experience after they had completed their clinical training.

Clinical laboratory teachers from the field were invited to participate in the survey in August 2001. Since the researcher had no information on who were involved in the actual clinical teaching in the hospitals, the questionnaire for hospital clinical laboratory staff (Appendix B) were sent to the pathology department managers for distribution. Colleagues who elected to join the study were asked to return the completed questionnaire by mail.

Five laboratory managers were interviewed between June to December, 2001. Their consent to participation (Appendix E) was obtained at the time of interview. Tape recording and note taking were used to ensure an accurate account of the discussions was recorded.

The same survey was administered to 35 year two biomedical science students (cohort 2) in January and May 2002 who were placed at six different centres. The decrease in number of participants was a result of a reduction in

student intake in the year 2000 due to restructuring of the department. In addition, two hospitals ceased to offer places for our students due to shortage of staff. Therefore with a smaller number of students and for better coordination, only six hospitals were chosen for clinical placement in the second phase of the study. Questionnaire for instructors was again sent to department managers in July 2002, for distribution. Data were collected and analyzed.

The Statistical Package for Social Sciences (SPSS) was used to perform statistical analyses. Descriptive statistics, paired t tests, independent samples t tests and one way ANOVA were used to measure any change in students' and instructors' views regarding clinical teaching, learning, organization of the programme and personal gain between pre and post clinical rotation and among different training centres. Although the basic instrument was a Likert type ordinal scale, commonly employed statistical tests such as the t test were used for the analysis. The robustness of the t test and one-way ANOVA to the violation of statistical assumption of normality and homogeneity of variance (Hopkins, Hopkins and Glass, 1996) makes it appropriate (Johnson and Creech, 1983). This is particularly so when a composite variable is involved, as in our case when a few items are grouped together to measure a specific dimension, the number of possible values increases, therefore it is an acceptable practice to treat these ordinal items as interval data. Regression analysis was used to determine factors that might predict students' achievements, such as students' GPA and subject grade of the clinical training. In addition, effect sizes were calculated for the subscales teaching, learning, organization and gain on both student cohorts, to enable easier visualization of the magnitude of change in students' perceptions on these aspects of the program and to allow comparison with other studies. The degree of changes were computed only on the four constructs for they are the major issues to be addressed in this study and a general overall effect estimated would be more meaningful. Since individual item only contribute to a fraction of the composite of each construct and because the position on each Likert scale can be directly interpreted, effect size was not calculated on single measures.

Intervention

Results of the statistical analysis from the first cohort of students and

clinical teachers were brought to the attention of members of the field training committee which was composed of hospital pathology department managers and university teaching staff of the biomedical science programme in its annual meeting in November 2001. The author reported to the committee that students welcomed the teaching approaches of the clinical teachers but were concerned about the inadequacy of hands-on practice and unclear objectives. Issues raised by clinical teachers concerning the attitudes of students, lack of communications between academic and hospital staff and insufficient manpower for clinical teaching were also documented. Plans on how to tackle these issues were discussed and recommendations were made with regard to students' learning and instructors' teaching. Entwistle (1992) discussed issues that would influence the quality of student learning. He concurred with Marton (1976) and Stevenson (1977) that intentions and perceptions of students would have an impact on the learning processes and strategies adopted by them. Whether a student embraces a deep or a surface approach to learning is apparently dependent on the student's orientation towards and perception of learning and these differences would in turn affect the quality of the learning outcome (Entwistle 1992). Some educators have suggested that learning environments (Entwistle 1991) and teaching behaviors (Brown 1970; Barnard 2001) such as respecting students and serving as role models are closely related to learning approach and satisfaction of the course. These factors have been linked to students' subsequent performance and professional growth (Griffith 2000; Roop 2001).

It was based on these concepts that a number of suggestions were made to promote:

1. student learning
2. improved clinical instructors' teaching
3. better organization of the programme

Actions taken included the followings: Specific topics were added to the briefing session held in January 2002 for the second cohort before they started their clinical rotation. In addition to the usual introduction of the structure and operation of the programme, students were acquainted with the working environment of different disciplines of the pathology laboratories. Emphases were placed on

objectives and aims. Individual items under each objective heading were discussed. For example, the need for confidentiality in test results and integration of theory to practice under the objective of clinical laboratory work were more fully explained. Safety measures and adherence to established policies under the objective of technical competence and skills were elaborated. Taking responsibility for ones own action and team spirit were stressed in professional and personal qualities. Learning attitudes and approaches, issues on values and professional ethics were also discussed.

Students from the previous cohort were invited to attend the meeting, to relate their personal experience on field training to the current cohort, so that students could have a better understanding of the programme. Past graduates shared with fellow students information on the workflow of the laboratories, different learning activities encountered in the clinical setting, the type of preparation required from students and offered suggestions as to how to approach clinical learning.

At the same time, department managers were to offer feedback to the survey findings and to discuss the teaching and learning issues with clinical teachers. Clinical teachers were encouraged to adopt different teaching methods, to hold more discussions, to provide more feedback and practice opportunities to students to promote students' learning. University staff were to increase their visits to hospitals to better communicate with laboratory staff. Although most clinical instructors have long years of clinical experience, like the medical profession (Wilkerson 1986; Bordley 2000), few have received teacher training to prepare them for their teaching role. Hence, teaching workshops were planned for clinical instructors to introduce to them the generic teaching skills and conceptions of teaching for development of teaching excellence. However, when the proposal was presented to the Hospital Authority, they had already scheduled an internal seminar on clinical teaching for clinical staff during that period. To avoid duplicating resources the university teaching workshop was not implemented. Three training sessions on clinical mentorship were conducted in August 2002 for allied health staff by the Hospital authority (Mentorship training programme report, Hospital Authority, 2002). One hundred and eight laboratory technologists attended the workshops and 25 (23%) of the participants were senior members of the staff. The

training programme aims to provide staff with an understanding of the role of a clinical mentor; to enhance staff's appreciation of the value and importance of mentoring. Video and case studies were used to equip clinical staff with necessary skills in facilitating learning of the allied health graduates. Unfortunately these sessions did not fit into students' field training period as they took place after the field training, hence this intervention could not be accounted for any change in the 2002 cohort. In addition, to recognize their contributions and to encourage their teaching, clinical teachers were invited as honorary clinical associates of the university.

Chapter 4 Results

Data Analysis

Following the methods and data collection as described in the preceding chapter, this chapter summarized the findings of the study under the framework of a feedback spiral (Stone, 1998). The results section is divided into two parts. First initial analyses of the perceptions of the first group of students, clinical teachers and laboratory managers on the clinical training programme were reported. Then results of the second cohort of the students and clinical teachers were presented.

The following are some of the questions to be answered in this section. How do students perceive the clinical training programme with respect to clinical teaching, learning, organization and personal gain? Are there changes in students' perceptions after the placement? What are the contributing factors? What could be done if these factors are affecting the effectiveness of the programme?

Results

Paired and independent-samples t-test were used in most parts of the analysis. These statistical procedures were used to determine if there were changes in students' perceptions on various aspects of the programme by comparing the means of different constructs before and after their clinical rotations. Means of individual items were also compared to identify perceptions differences in specific areas of the programme. Influence of placement centres on students' perceptions and differences in the views of the clinical instructors from various hospitals were analyzed by ANOVA. Significant findings were followed up by post-hoc tests to reveal specific means differences among all variables. Qualitative data from students' and instructors' comments and interviews from laboratory managers were interpreted to find common and contrasting areas between qualitative and quantitative results. These findings would help to clarify if students were satisfied with their clinical experience, what were the factors that had changed the perceptions of the students and how did clinical instructors view the programme. Recommendations for change were made based on information from the analysis.

Interventions were adopted as outlined in chapter three (p. 55). The report then continued to present findings on the second cohort. Paired-sample t-tests were again used to analyze data on views of the programme from the second group of students and instructors. Differences in perceptions on the programme between the two cohorts of students and instructors were investigated by comparing the means of different constructs. Students' GPAs were computed as an outcome measure of the programme. Regression analysis was applied to determine the variables in the programme that could best predict the outcomes such as students' GPAs and field training grades.

The First Phase Results:

Measurements of perceptions of the first student cohort on the programme

Table 3 – Comparison of students’ pre and post clinical training ratings on the four subscales (cohort 1)

Training		N	Mean	Std. Deviation	t	Paired-Mean difference	Sig. (2-tailed)	Effect Size
Clinical Teaching	Pre	55	3.59	.54	2.03	.17	.04*	-.31
	Post	55	3.42	.45				
Learning	Pre	56	3.93	.52	3.50	.26	<.01*	-.52
	Post	56	3.66	.48				
Organization	Pre	53	3.68	.53	2.80	.23	<.01*	-.44
	Post	53	3.45	.51				
Personal gain	Pre	54	3.85	.54	2.23	.17	.03*	-.31
	Post	54	3.68	.45				

* The mean difference is significant at .05 level

Effect size = (post training mean minus pre training mean) divided by pre training standard deviation

Paired sample t tests were run to examine if there are significant differences on the perceptions of students on the four subscales before and after their clinical placement. The results in Table 3 show that there were significant differences in the means of the subscales clinical teaching (t=2.03, p=0.04), learning (t=3.50, p<.01), organization (t=2.80, p<.01) and personal gain (t= 2.23, p= .03). The inspection of the four group means indicates that the pre training average scores on clinical teaching, learning, organization and personal gain were significantly higher than

those of the post training scores. It appears that there were negative differences between what were expected and what were achieved on students' clinical experience. In addition, the magnitude of negative changes were moderate in all four dimensions, as reflected by the effect sizes of -.31 for clinical teaching, -.52 for learning, -.44 for organization and -.31 for personal gain.

In order to pin point which particular area was responsible for the differences in students' perceptions, paired sample t tests were run on all items for each subscale.

Table 4 – Comparison of students' pre and post clinical training ratings of the subscale - clinical teaching (cohort 1)

Clinical Teaching	Train- ing	N	Mean	Std. Devia- tion	t	Paired Mean difference	Sig. (2- tailed)
The clinical teacher had communicated the learning objectives to me.	Pre	56	3.89	.62	2.26	.26	.02*
	Post	56	3.63	.64			
The clinical teacher took steps to ensure that I progressed well with my learning.	Pre	56	3.96	.87	3.46	.54	<.01*
	Post	56	3.42	.73			
It was difficult to know what was expected of me in the clinical areas.	Pre	56	2.60	.80	-.83	-.11	.41
	Post	56	2.71	.82			
The clinical teacher listened to my views and was open to suggestions.	Pre	56	3.60	1.00	.00	.00	1.0
	Post	56	3.60	.68			
The clinical teacher encouraged me to perform a variety of clinical techniques.	Pre	55	3.80	.86	1.35	.22	.18
	Post	55	3.58	.91			
There have been plenty of opportunities to ask questions and discuss ideas with my clinical teacher.	Pre	56	3.64	.94	1.06	.16	.29
	Post	56	3.48	.78			

* The mean difference is significant at .05 level.

When we examined items under the subscale clinical teaching (Table 4), the results show that there were decreases in the means of the items ‘the clinical teacher had communicated the learning objectives to me’ and ‘the clinical teacher took steps to ensure that I progressed well with my learning’. The differences in the means of pre and post measurements were significant (with t=2.26, p=.02 for the first item and t=3.46, p<0.01 for the second item). It appears that students were

unsure of their learning objectives and they had anticipated that these aims would be communicated to them by their instructors. In addition, the amount of attention they expected to receive from clinical teachers was not what they had perceived.

There was no significant difference in the means of other items in this subscale, suggesting that there was not much change in students' perception on clinical teaching and it was conducted the way student had expected. Despite this it should be noted that for all but one item the mean scores fell and that each contributed to the overall drop shown in Table 3.

Table 5 – Comparison of students' pre and post clinical training ratings of the subscale - learning (cohort 1)

Learning	Train- ing	N	Mea n	Std. Devia- tion	t	Paired Mean difference	Sig. (2- tailed)
I have spent time to prepare for the placement.	Pre	56	3.96	.65	3.72	.46	<.01*
	Post	56	3.50	.71			
I always attempt to seek for solutions to difficulties I encounter.	Pre	56	3.91	.72	1.56	.17	.12
	Post	56	3.74	.58			
I have placed a lot of effort on the tasks assigned to me.	Pre	56	3.92	.70	1.58	.16	.12
	Post	56	3.76	.66			

* The mean difference is significant at .05 level.

For the subscale learning (Table5), there was significant difference in the means of the item “I have spent time to prepare for the placement’ between students’ pre and post training scores ($t=3.72$, $p<.01$), which reveals that students had not spent as much time to prepare for their placement as they had planned. However, there was no significant difference in the means of the other two items despite both fell.

Table 6 – Comparison of students’ pre and post clinical training ratings of the subscale – organization (cohort 1)

Organization	Train-ing	N	Mean	Std. Devia-tion	t	Paired Mean difference	Sig. (2-taile d)
I have adequate exposure to different equipment.	Pre	56	3.91	.90	3.65	.60	<.01*
	Post	56	3.30	.98			
The working environment is harmonious.	Pre	54	3.45	.69	-.29	-.04	.77
	Post	54	3.48	.74			
Theory and practical work were integrated at the laboratory.	Pre	56	3.62	.88	1.49	-.23	.14
	Post	56	3.39	.73			
The hospital environment I worked in has contributed positively to my learning.	Pre	56	3.82	.83	1.84	.25	.07
	Post	56	3.57	.78			
Laboratory staff has accepted me as a member of the team.	Pre	55	3.38	.97	1.16	.18	.25
	Post	55	3.20	1.00			
The working environment was neat and tidy.	Pre	56	3.87	.78	1.09	.12	.28
	Post	56	3.75	.74			

* The mean difference is significant at .05 level.

With regard to organization (Table 6), the only item that shows a significant difference in the means between pre and post training scores was ‘I have adequate exposure to different equipment’ ($t=3.65$, $p<.01$). The results suggest that opportunities for students to practice on different equipment was significantly less than what they had in mind which is an issue to be explored in this study. Although there were slight decreases in the means of post training scores as compared to pre training scores in other items, the mean differences were not significant. These data suggested that students were satisfied with the learning environment and its contribution to their learning.

Table 7 – Comparison of students’ pre and post clinical training ratings of the subscale – personal gain (cohort 1)

Personal gain	Train- ing	N	Mea n	Std. Deviation	t	Paired Mean difference	Sig. (2- tailed)
I am more confident to perform tasks that I have learned in clinical rotations.	Pre	56	3.82	.78	1.04	.12	.30
	Post	56	3.69	.63			
My hands on experience has further developed my professional skills.	Pre	56	4.04	.71	1.76	.16	.08
	Post	56	3.87	.57			
Clinical training has helped me to appreciate my future professional responsibilities.	Pre	55	3.95	.91	1.52	.22	.13
	Post	55	3.72	.73			
I have learned how to transfer my knowledge to new situations.	Pre	55	3.81	.72	2.12	.22	.04*
	Post	55	3.60	.65			
Working in the clinical setting has enabled me to better understand patient care.	Pre	56	3.62	.84	.36	.05	.72
	Post	56	3.57	.81			

* The mean difference is significant at .05 level.

As shown in Table 7, a significant difference was observed in the mean on the item ‘I have learned how to transfer my knowledge to new situations’ ($t=2.12$, $p=.04$). The result appears to suggest that students’ clinical experience was not able to help students learn to apply knowledge into practice. Lower post training means were also found on the other items, however, the differences were not significant. Students appear to agree that although not to their fullest expectation, the programme had met its objectives in developing their confidence, professional skills and personal qualities. As an aside, it might be worth noting that although the separate questions were designed to relate to a single construct the analyses of the report items showed that they were important in their own right.

Table 8 – Comparison of students’ post training ratings on the four subscales by centre (cohort 1)

Centre 1-10	N	Mean	Std. Deviation	F-value	Sig.
Teaching	66	3.39	.44	1.39	.21
Learning	66	3.65	.52	1.81	.08
Organization	64	3.47	.50	2.19	.04*
Personal gain	64	3.65	.46	1.25	.28

* The mean difference is significant at .05 level.

Scores from students' post training ratings were used in this analysis. In Table 8, the ANOVA computed for students placed at different centres reveals that there was significant difference in the means of the subscale organization ($F=2.19$, $p=.04$). The mean differences for the other three subscales, clinical teaching, learning and personal gain were not significant, implying that students' views with regard to clinical teaching, learning and personal gain were quite similar among centres.

To explore where the significant difference lies, the Tukey post-hoc test was performed for centres regarding students' perception on organization, however no significant mean difference was found.

In order to investigate if there is indeed no significant difference in the means of the four subscales among centres, and the negative findings were not due to differences in perceptions at the start, residuals were computed through regression (using post score as the dependent variable and pre score as the independent variable) and compared by ANOVA.

Table 9 – Comparison of the computed residuals of students' post training perceptions on various dimensions by centre (cohort 1)

	Centre 1-10	N	Mean	Std. Deviation	F-value	Sig.
Teaching	total	55	-.04	.44	1.25	.28
Learning	total	56	.01	.45	2.12	.05
Organization	total	53	.07	.48	1.51	.17
Personal gain	total	54	.01	.41	1.88	.08

As indicated in Table 9, there was no significant difference in the means of the residuals of the four subscales among centres for students. The results may indicate that the clinical experience encountered by the same group of students at various centres was similar, and their perceptions on the four aspects in the training programme were not significantly different.

To further explore specific differences in students' perceptions from different centres, ANOVA was performed on individual items.

Table 10 – Comparison of students' post training ratings on specific items of the four subscales by centres (First cohort)

Centre 1-10	N	Mean	Std. Devia- tion	F- value	Sig.
Clinical Teaching					
The clinical teacher had communicated the learning objectives to me.	66	3.63	.64	.92	.51
The clinical teacher took steps to ensure that I progressed well with my learning.	66	3.42	.70	.88	.54
It was difficult to know what was expected of me in the clinical areas.	66	2.66	.79	.48	.88
The clinical teacher listened to my views and was open to suggestions.	66	3.56	.68	.53	.84
The clinical teacher encouraged me to perform a variety of clinical techniques.	66	3.55	.89	2.62	.01*
There have been plenty of opportunities to ask questions and discuss ideas with my clinical teacher.	66	3.53	.76	1.49	.17
Learning					
I have spent time to prepare for the placement.	66	3.47	.70	1.59	.14
I always attempt to seek for solutions to difficulties I encounter.	66	3.74	.64	1.17	.32
I have placed a lot of effort on the tasks assigned to me.	66	3.75	.72	.84	.57
Organization					
I have adequate exposure to different equipment.	66	3.25	.99	2.1	.04*
The working environment is harmonious.	65	3.49	.73	1.94	.06
Theory and practical work were integrated at the laboratory.	66	3.36	.75	1.34	.23
The hospital environment I worked in has contributed positively to my learning.	66	3.62	.79	.43	.90
Laboratory staff has accepted me as a member of the team.	64	3.27	.99	2.79	.01*
The working environment was neat and tidy.	66	3.78	.75	2.15	.04*
Personal gain					
I am more confident to perform tasks that I have learned in clinical rotations.	66	3.69	.65	1.52	.16
My hands on experience has further developed my professional skills.	66	3.85	.58	1.12	.25
Clinical training has helped me to appreciate my future professional responsibilities.	64	3.70	.76	.87	.55
I have learned how to transfer my knowledge to new situations.	65	3.58	.68	.89	.53
Working in the clinical setting has enabled me to better understand patient care.	66	3.53	.80	1.17	.32

* The mean difference is significant at .05 level.

Results in Table 10 showed that there were significant differences in the means of the following items, 'the clinical teacher encouraged me to perform a variety of clinical techniques' (F=2.62, p=.01); 'I have adequate exposure to different equipment' (F=2.1, p=.04), 'the working environment was neat and tidy'

($F=2.15$, $p=.04$) and 'laboratory staff has accepted me as a member of the team' ($F=2.79$, $p=.01$). These findings suggest that students from different centres had different views regarding relation with clinical teachers and opportunities to practice.

Comparisons of clinical instructors' ratings on the programme

Table11 – Comparison of clinical instructors' ratings of the four subscales by centre (First cohort)

Centre 1-10	N	Mean	Std. Deviation	F-value	Sig.
Teaching	128	3.63	.49	.79	.62
Learning	128	3.30	.64	2.37	.01*
Organization	128	3.10	.64	2.33	.01*
Personal gain	129	3.37	.73	2.23	.03*

* The mean difference is significant at the .05 level.

For surveying clinical instructors' perceptions on the programme, ANOVA was used to compare the means of instructors' perceptions of the four constructs at different centres (Table 11). The results show that there were significant differences in the means of learning ($F=2.37$, $p=.01$), organization ($F=2.33$, $p=.01$) and personal gain ($F=2.23$, $p=.03$).

In order to determine which specific pairs of means were significantly different, the Tukey post-hoc test (Table 12) was performed to follow up on results of the ANOVA.

Table 12 – Tukey post-hoc test for centres on clinical instructors' ratings

Dependent variable	(I) Centre	(J) Centre	Mean Difference (I-J)	Std error	Sig.
Learning	6	1	.28	.29	.99
		2	.40	.25	.84
		3	.65	.27	.36
		4	.20	.31	1.00
		5	.93*	.28	.04
		7	.64	.24	.19
		8	.74	.29	.27
		9	.67	.31	.50
		10	.63	.29	.47
Organization	8	1	-.76	.27	.14
		2	-.75*	.23	.04
		3	-.68	.25	.18
		4	-1.04*	.22	.01
		5	-.50	.28	.64
		6	-1.03*	.25	.01
		7	-.67	.25	.10
		9	.29	.29	.99
		10	-.72	.26	.18
Personal gain	1	2	.33	.26	.96
		3	.30	.29	.98
		4	.06	.33	1.00
		5	1.00*	.30	.03
		6	.33	.30	.98
		7	.41	.26	.85
		8	.80	.31	.25
		9	.25	.33	.99
		10	.09	.30	1.00

*The mean difference is significant at .05 level.

The results show that significant differences were present in the means between centre 5 (mean=2.83) and centre 6 (mean=3.77) in the learning dimension; between centre 1 (mean=3.75) and centre 5 (mean=2.75) in the personal gain category. The largest number of differences were found in the organization subscale where the mean of centre 8 (mean 8=2.48) was significantly different from means of centres 2 (mean=3.23), 4 (mean=3.52) and 6 (mean=3.51). These findings reflect that teachers from these centres have different opinions on issues relating to learning of the students, the organization of the programme as well as their satisfaction.

Table 13 – Comparison of clinical instructors' ratings on specific items of the scales by centres (First cohort)

Centre 1-10	N	Mean	Std. Devia- tion	F- valu e	Sig.
Teaching					
Students' field training objectives were made clear to laboratory teaching staff.	129	3.71	.78	1.27	.26
Theory and practical work were integrated at the laboratory in clinical teaching.	128	3.57	.80	.90	.52
Relevant teaching materials were prepared in advance by laboratory teaching staff.	129	3.18	.92	2.34	.01*
A variety of appropriate examples were used in all explanations and demonstrations.	129	3.36	.81	1.13	.34
A relaxed style was adopted when explaining or demonstrating.	128	3.83	.71	2.19	.02*
Individual feedback and corrective instructions were provided.	129	3.63	.73	.49	.87
Students were ensured to have experience success and feelings of competence.	128	3.42	.77	1.44	.17
Learning					
Students were more competent after training.	129	3.60	.92	1.01	.42
Students were enthusiastic and keen to learn various techniques.	128	3.06	.89	1.83	.06
Students were conscientious and responsible.	129	3.24	.84	1.91	.05*
Students were able to monitor their own learning.	129	3.05	.83	1.78	.07
Organization					
Communication between laboratory teaching staff and university academic staff was adequate.	129	2.76	.76	1.56	.13
Communication between laboratory teaching staff and students was adequate.	128	3.57	.78	.52	.85
Students had adequate opportunities to perform various tasks relevant to their level.	129	3.41	.92	3.54	<.01*
The number of staff for student supervision was adequate.	129	3.31	1.08	2.12	.03*
Clinical teaching does not interfere with laboratory staff's routine work.	129	2.62	1.00	2.12	.03*
Personal gain					
The students' field placement provided laboratory teaching staff opportunities to improve skills in personal communication and organization.	129	3.41	.91	3.14	<.01*
The clinical teaching experience had increased laboratory teaching staff's awareness of their strengths and weaknesses as teachers.	129	3.59	.86	1.98	.04*
Clinical teaching provided laboratory teaching staff with opportunity to gain further insight in professional development.	129	3.3	.86	1.93	.53
Clinical teaching enabled laboratory teaching staff to keep abreast of new techniques and theories of modern technology.	129	3.17	.97	1.29	.24

*The mean difference is significant at .05 level.

In Table 13, a computation of ANOVA on all specific items of the four subscales reveals that although the overall mean difference of clinical teaching was not significant, two items within this construct showed significant differences in their means, the item 'relevant teaching materials were prepared in advance by laboratory teaching staff' ($F=2.34$, $p=.01$) and 'a relaxed style was adopted when explaining or demonstrating' ($F=2.19$, $p=.02$). The findings reveal that adequacy on preparation and the approach on teaching were quite different in some centres.

Items that differed significantly in the learning subscale was 'students were conscientious and responsible' ($F=1.91$, $p=.05$). The results suggest that students learning attitudes varied significantly at some centres, particularly between centre 5 and centre 6. Although, of course, these were the views of the instructors.

With regard to the subscale personal gain, there were significant differences in the means of two items 'the students field placement provided laboratory teaching staff opportunities to improve skills in personal communication and organization' ($F=3.14$, $p<.01$), and 'the teaching experience had increased laboratory teaching staff's awareness of their strengths and weaknesses as teachers' ($F=1.98$, $p=.04$). No significant difference was found in the other items. These results indicate that staff at certain centres did not perceive clinical teaching as opportunities for their own personal development and staff at centre 1 had a more positive rating in this respect as compared to staff of centre 5.

When we examine the items on the subscale organization, there were significant differences in the means of the items 'students had adequate opportunities to perform various tasks relevant to their level' ($F=3.54$, $p<.01$), 'the number of staff for student supervision was adequate' ($F=2.12$, $p=.03$) and 'clinical teaching does not interfere with laboratory staff's routine work' ($F=2.12$, $p=.03$). These results suggest that clinical teaching staff at different centres had significant differences over the issues on whether students had adequate practice opportunities, if enough staff were available to supervise students and whether clinical teaching had affected staff's routine service. These findings may have implication on the teaching practice of the clinical instructors.

In the current study, centre 8 (Table 12) was found to have the lowest means among centres in the subscale organization. This result appears to reflect the frustration encountered by the laboratory staff of this centre in the field training programme was particularly intense.

Qualitative results (first phase)

Although they may share the same theme, presentation of responses from different participants vary, therefore, a different approach is adopted for qualitative data analysis. Most clinical teachers and students in this study responded to the open-ended questions of the questionnaires in short sentences or in point forms, hence, the themes presented were first sorted into categories and responses are documented in terms of frequency.

Data analysis on the interviews involved a more complex procedure. A list of pre-set questions was used as a guide (Appendix C) to conduct interviews with laboratory managers. The full record of the conversations was tape-recorded in conjunction with note taking. Data of each of the five interviews were transcribed into text. After reviewing the text, a list of coding categories was developed. Codes were assigned to phrases or words as expressed in the transcripts such as communication, initiatives, learning approaches, motivation and commitment. All of the data coded were then arranged into categories and analyzed to reconstruct themes drawn from the interviews (for example, initiatives, motivation and commitment would be grouped under the category learning attitude). Sentences and paragraphs sharing the same thoughts were reviewed and interpreted to link the materials presented to the research questions. Perceptions shared by three or more laboratory managers would be chosen as the representations.

The following section will present the responses from students and teachers as well as interview data from the laboratory managers.

Students' responses to the open-ended questions of the post training questionnaire are summarized as follows:

Responses frequency in descending order:

1. What do you like most about the ways the clinical teacher taught you?

	No. of times mentioned
- to provide practice	16
- discussions between clinical staff and students to promote learning	7
- questions and answers format to promote learning	6
- demonstrations with explanation from clinical instructors	6
- being treated like member of staff	6
- able to participate in real laboratory	5
- staff's willingness to teach	4
- communication with instructors	1
- clinical teachers monitor my progress	1

2. What are the areas that you could suggest changes in clinical teaching?

- more hands on practice	14
- staff too busy to teach	4
- more detail objectives	3
- field training too short	2
- field training too long	2
-- to have schedule before rotation	1
- staff should initiate teaching	1

Forty-seven students responded to the open questions and their written comments echoed the quantitative findings. Although some of the responses to question one did not really address the question, the feedback reflected that opportunities to practice remained to be the major concern of students. While some students welcomed the chance to participate in real laboratory procedures, others had expressed their wish to have more hands on practice. Moreover, it also appeared that some students had enjoyed the questions and answers sessions and discussions with their clinical instructors while others complained that laboratory staff were too busy to teach them. Nevertheless, specific teaching approaches cited by students had supported their perceptions on the dimension of clinical teaching.

Clinical instructors' comments from the survey

Responses frequency in descending order: No. of times mentioned

- | | |
|--|---|
| • Shortage of staff | 9 |
| • Students' poor learning attitude | 7 |
| • To increase communication between university and the clinical facilities | 6 |
| • To shorten the training session | 4 |
| • To improve teacher and student relation | 2 |
| • To employ different teaching approaches | 2 |

Thirty clinical teachers gave their feedback regarding improvement in the training programme. According to the results, shortage of staff, students' learning attitude and communication between university and the clinical facilities were the specific items most frequently cited. The following are some of the comments, which have been selected to provide an illustration, provided by the teachers.

Staff shortage -

'It is indeed a difficult time for the HA (Hospital Authority) laboratory staff to spare sufficient time for clinical teaching due to tremendous workload'.

'Lab manpower is a constraint these days, which decreases supervision effectiveness'.

'Staff shortage is a problem which leads to improper training of students'.

Students' attitude –

'The enthusiasm or eagerness of student to learn has declined, may be due to the pessimistic prospect in pursuing career in MLS (Medical Laboratory Science)'.

'Most students were not so enthusiastic as before (previous students). They did not demonstrate interest during the attachment'.

Communication –

'Communication between lab staff and students needs to be improved'.

'More communication between lab and university staff is very important in monitoring the progress of training and helping the students'.

Department managers' comments from interviews on organization of the programme are as follows:

One manager (centre 9) commented:

「溝通, 大學與前線同事未有正式的交流, 我們也明白到大學同事不知道誰在醫院是導師, 又是別人的地方, 但可以在醫院舉行 (會議)」

“Communication between university staff and frontline staff are inadequate. We understand that it's difficult for you, since you don't know who are involved in the actual teaching, and you are not familiar with the workplace, however, informal meeting can be held at the hospital”.

Another manager concurred with the above comments (centre 7):

「你們到醫院探訪, 只是局限於會見部門經理, 最多是與 SMT 或幾個相熟的同事交談, 很少與 bench technologist 溝通」

“When you (university staff) visit the hospital, you only meet with department manager, and senior medical technologists or the few people you know, very seldom you talk to bench technologists”

One manager felt that communications between university and hospital staff were adequate however, improvement could be made, as she commented (centre 9):

「溝通也算足夠, 但可在實習後, 讓學生有 feedback 給 trainer, 如果 reasonable, 可以正視」

“Communication between university and hospital staff is acceptable, however, if students feedback can be given to clinical laboratory instructors, if they are reasonable, we will see what we can do about them.”

The laboratory manager from centre 1 expressed his view on communication.

「多些與醫院同事溝通, 可以知道學生的問題及需要所在」

“To have more communication with hospital staff, can find out students' problems.”

The manager of centre 9 pointed out one of the issues of the current clinical training programme.

「現在人手短缺, 要看看時間表, 可能照顧不太全面」

“There is an increasing demand on laboratory service, this may affect supervision on student. It may not be as good as it should be.”

When department managers were asked to express their opinions on teaching, they had the following comments:

「我們都很清楚這個實習的目標。讓同學接觸化驗室的不同層面，補足書本上及大學在職業上提供不到的」(centre 9)

“We are clear about the objectives of the programme. This programme aims to introduce to students different areas of the laboratory, complementing theories being taught at the university.”

「目標都在學生手冊內清楚列明」(centre 3)

“Objectives are all clearly stated in the student handbook.”

「我們只需學生學習最基本的技術、安全守則，化驗室的運作及以病人為中心的工作。」(centre 7)

“We just require the students to learn the basic techniques, safety procedures, operation of the laboratory and the patient-centred nature of the work.”

「導師要具備知識、耐心、有引導能力及用不同教學方法。」(centre 1)

“Clinical teachers need to be knowledgeable, patience, be able to motivate students and adopt different teaching approaches.”

「教學相長」(centre 3)

“Teaching and learning are interactive and complementary.”

「我們在每一個實習階段完成後，卻有與他們作討論。」(centre 1)

“We hold discussion with them after each clinical rotation.”

「我們用問題方式來引導同學的學習。」(centre 4)

“We use questions to guide their learning”

「導師是 facilitator, 引導學生學習。」(centre 9)

“Clinical instructors are facilitator, facilitating students to learn.”

「可能有些導師太着重技術的教導，對教學不太全面。」(centre 9)

“Some instructors may be too focused on the technical aspects, lack holistic view of teaching.”

Interview comments characterizing students' learning attitudes are given as follows:

「學生不太主動，比較鬆散」 (centre 3)

“Students lack motivation, they do not focus ”

「學生不投入，他們應該知道的角色，要有心在這行業。」 (centre 1)

“Students lack the passion. They should have that kind of commitment if they wish to join the profession.”

「不單在技術上的學習，學生應學習人與人的關係，學習分工及團隊精神。」 (centre 7)

“Not just to learn technical procedures. Students should learn about communication, people relationship, and team work.”

「學生應多發問，在做完每一個程序後，回家應溫習，有什麼問題，應把握時機，第二天回來便問導師。」 (centre 1)

“Students should ask more questions. They should review each procedure after completing the task, and should ask questions if they are not sure of anything.”

「不太主動，中國人的傳統。」 (centre 1)

“Passive, Chinese people's culture.”

「很靜，可能與前景不太樂觀有關。」 (centre 4)

“This year's students are very quiet, probably has to do with present poor job opportunities.”

Interview comments from department managers revealed that clinical laboratory staff were clear about the objectives of the programme, different teaching approaches were adopted and feedback were provided to students. Concerns on the issues of students' learning attitudes and insufficient staff resources were reported. In addition, department managers felt that communication between university and hospital staff could be improved to promote the understanding of the needs of the students, such that change could be implemented to enhance students' learning.

Summary of the findings of the first stage

Results up to this point suggested that objections raised by students which led to differences between students' pre and post training ratings on the subscales

clinical teaching and organization were insufficient hands on opportunities and unclear objectives. The major significant difference in their perception regarding learning was a reduction in the effort they placed in preparation for their placement. It appeared that students agreed that clinical laboratory teachers were helpful and receptive to students, the learning environment had contributed positively to their learning and the programme had helped them in the development of technical skills and professional qualities. Different training centres did not appear to create different clinical experience for the students, as it was reflected on very similar ratings from students from different centres. At the same time, clinical laboratory instructors revealed their concerns on students' learning attitudes and the shortage of staff for student supervision. It was based on these findings that measures were taken to improve the programme. (Please refer to intervention measures on p.56).

The Second Phase Results

Measurements of perceptions of students on the programme (cohort 2)

The following results were computed from data of the second student cohort, after implementation of some intervening measures (p. 56)

Table 14 – Comparison of students’ pre and post clinical training ratings of the four subscales (cohort 2)

Training		N	Mean	Std. Deviation	t	Paired-Mean difference	Sig. (2-tailed)	Effect Size
Clinical Teaching	Pre	31	3.17	.58	-2.77	-.32	.01*	.55
	Post	31	3.49	.39				
Learning	Pre	31	4.02	.56	2.63	.36	.01*	-.66
	Post	31	3.65	.54				
Organization	Pre	31	3.41	.45	-2.07	-.17	.04*	.37
	Post	31	3.58	.41				
Personal gain	Pre	31	3.86	.44	1.68	.20	.10	-.48
	Post	31	3.65	.44				

* The mean difference is significant at .05 level.

Effect size = (post training mean minus pre training mean) divided by pre training standard deviation

As shown in Table 14, the mean differences in the dimensions clinical teaching (t= -2.77, p=.01), learning (t= 2.63, p=.01) and organization (t= -2.07, p= .04) were significant between pre and post ratings of the second student cohort. No significant difference in the means of the subscale personal gain was found. The

findings indicate that students had changed their perceptions on some issues relating to clinical teaching, learning and organization through their clinical experience. While there were negative changes in the subscales of learning and personal gain with moderate effect sizes of -.66 and -.48, positive changes were observed in the clinical teaching and organization subscales with modest effect sizes of .55 and .37. To reveal detail changes in students' perceptions on the four constructs, paired samples t test was run on all items of each subscale.

Table 15 – Comparison of students' pre and post clinical training ratings of the subscale clinical teaching (cohort 2)

	Year	N	Mean	Std. Deviation	t	Paired Mean difference	Sig. (2-tailed)
The clinical teacher had communicated the learning objectives to me.	Pre	31	3.64	.95	.36	.06	.72
	Post	31	3.58	.62			
The clinical teacher took steps to ensure that I progressed well with my learning.	Pre	31	3.29	1.00	-1.39	-.29	.17
	Post	31	3.58	.56			
It was difficult to know what was expected of me in the clinical areas.	Pre	31	2.83	.86	-.96	-.23	.35
	Post	31	3.06	.81			
The clinical teacher listened to my views and was open to suggestions.	Pre	31	3.16	.86	-3.15	-.64	<.01*
	Post	31	3.80	.65			
The clinical teacher encouraged me to perform a variety of clinical techniques.	Pre	31	3.25	.85	-1.44	-.25	.16
	Post	31	3.51	.72			
There have been plenty of opportunities to ask questions and discuss ideas with my clinical teacher.	Pre	31	2.83	.73	-3.65	-.58	<.01*
	Post	31	3.41	.84			

*The mean difference is significant at .05 level.

In Table 15, increases in the means were found in almost all items of the post training ratings under this category. Significant differences in the means of the item 'the clinical teacher listened to my views and was open to suggestions' ($t = -3.15, p < .01$) and the item 'there have been plenty of opportunities to ask questions and discuss ideas with my clinical teacher' ($t = -3.65, p < .01$) were reported. This seems to imply that students welcomed the teaching approaches of the clinical laboratory instructors and their clinical experience had positively changed their views, hence, more favorable ratings on teaching were obtained after their clinical rotation.

Table 16 – Comparison of students’ pre and post clinical training ratings of the subscale learning (cohort 2)

	Year	N	Mean	Std. Deviation	t	Paired Mean difference	Sig. (2-tailed)
I have spent time to prepare for the placement.	Pre	31	4.29	.73	4.46	.87	<.01*
	Post	31	3.41	.72			
I always attempt to seek for solutions to difficulties I encounter.	Pre	31	3.96	.75	1.42	.23	.16
	Post	31	3.74	.68			
I have placed a lot of effort on the tasks assigned to me.	Pre	31	3.80	.87	.00	.00	1.00
	Post	31	3.80	.65			

* The mean difference is significant at .05 level.

With reference to learning (Table 16), the item which had a significant decrease in the means was ‘I have spent time to prepare for the placement’ ($t=4.46$, $p<.01$). It appears that both cohorts of students (cohort 1 and cohort 2) had reported spending less time to prepare for the placement and further investigation is needed to look into this issue.

Table 17 – Comparison of students’ pre and post clinical training ratings of the subscale organization (cohort 2)

	Year	N	Mean	Std. Deviation	t	Paired Mean difference	Sig. (2-tailed)
I have adequate exposure to different equipment.	Pre	31	3.45	.80	-1.09	-.16	.28
	Post	31	3.61	.66			
The working environment is harmonious.	Pre	31	3.16	.68	-1.42	-.29	.16
	Post	31	3.45	.85			
Theory and practical work were integrated at the laboratory.	Pre	31	3.74	.68	.94	.12	.35
	Post	31	3.61	.76			
The hospital environment I worked in has contributed positively to my learning.	Pre	31	3.61	.66	-1.23	-.19	.22
	Post	31	3.80	.60			
Laboratory staff has accepted me as a member of the team.	Pre	31	2.90	.65	-2.50	-.41	.01*
	Post	31	3.32	.65			
The working environment was neat and tidy.	Pre	31	3.61	.80	-.59	-.09	.55
	Post	31	3.70	.64			

* The mean difference is significant at .05 level.

In the dimension organization (Table 17), significant difference in the means was found in the item ‘laboratory staff has accepted me as a member of the team’, ($t=-2.5$, $p=.01$), suggesting a good staff-student relationship. As for the item

'I have adequate exposure to different equipment', although the mean difference was not significant, there was an increase in the post rating mean score, which indicates that more practice were received by students than anticipated. An increase in the mean of most items after clinical rotation was also evident.

Table 18 – Comparison of pre and post clinical training ratings of the subscale personal gain (cohort 2)

	Year	N	Mean	Std. Deviation	t	Paired Mean difference	Sig. (2-tailed)
I am more confident to perform tasks that I have learned in clinical rotations.	Pre	31	3.73	.82	.94	.19	.35
	Post	31	3.54	.57			
My hands on experience has further developed my professional skills.	Pre	31	3.93	.77	.89	.16	.38
	Post	31	3.77	.76			
Clinical training has helped me to appreciate my future professional responsibilities.	Pre	31	3.93	.57	1.09	.19	.28
	Post	31	3.74	.68			
I have learned how to transfer my knowledge to new situations.	Pre	31	3.93	.62	1.87	.29	.07
	Post	31	3.64	.66			
Working in the clinical setting has enabled me to better understand patient care.	Pre	31	3.77	.66	.94	.19	.35
	Post	31	3.58	.67			

As shown in Table 18, no significant difference in the means of the items from the personal gain sub-scale between pre and post scores was found. It appears that students' perceptions on clinical learning outcomes including the development in professional, technical and personal qualities were close to their expectation.

Table 19 – Comparison of students' ratings on the four subscales by centre (cohort 2)

Centre 1, 3, 5, 7, 8, 9	N	Mean	Std. Deviation	F-value	Sig.
Teaching	31	3.49	.39	1.10	.38
Learning	31	3.65	.54	1.49	.23
Organization	31	3.58	.41	1.05	.40
Personal gain	31	3.65	.44	1.19	.34

The post training ratings from students were used in this computation and the findings in Table 19 indicate that there was no significant mean difference on students' ratings of the four subscales among the 6 centres.

Again, to investigate if there is indeed no significant difference in the means of the four subscales among centres, and the negative findings were not due to differences in perceptions at the start, residuals were computed through regression (using post score as the dependent variable and pre score as the independent variable) and compared by ANOVA.

Table 20 – Comparison of computed residuals of students' perceptions on the four dimensions by centre (cohort 2)

	Centre 1, 3, 5, 7, 8, 9	N	Mean	Std. Deviation	F-value	Sig.
Teaching	total	31	5.44E-16	.39	.99	.44
Learning	total	31	1.43E-16	.54	1.51	.22
Organization	total	31	1.01E-15	.38	1.39	.26
Personal gain	total	31	-3.44E-16	.42	1.76	.15

As indicated in Table 20, there was no significant difference in the means of the four subscales among centres for students. The results may indicate that students at various centres had similar experience and their perceptions on the four aspects in the training programme were not significantly different.

Comparisons of clinical instructors' ratings on the programme (cohort 2)

Table 21 – Comparison of clinical instructors' ratings of the four subscales by centre (second cohort)

	N	Mean	Std. Deviation	F-value	Sig.
Teaching	25	3.59	.39	1.04	.42
Learning	25	3.26	.62	2.90	.04*
Organization	24	3.20	.55	1.07	.40
Personal gain	24	3.81	1.11	.09	.99

*The mean difference is significant at .05 level.

As shown in Table 21, ANOVA was used to investigate the differences in the views of the second group of clinical teachers on the four dimensions of the study. A significant difference in the mean of the category learning ($F=2.90$, $p=.04$) was found, showing that teachers among different centres had different opinions on students' learning. Tukey post-hoc was performed to follow up the results, however, no significant difference between any centres pair was observed.

In order to gain better understanding of the clinical teachers' perceptions on the training programme, comparison on individual items was made by ANOVA. The results are presented in Table 22.

Table 22 – Comparison of clinical instructors' ratings on specific items of the four subscales by centre (second cohort)

Centre 1, 3, 5, 7, 8, 9 Total	N	Mean	Std. Deviation	F- value	Sig.
Teaching					
Students' field training objectives were made clear to laboratory teaching staff.	25	3.56	1.19	.92	.48
Theory and practical work were integrated at the laboratory in clinical teaching.	25	3.52	.87	1.57	.21
Relevant teaching materials were prepared in advance by laboratory teaching staff.	25	3.24	.66	.80	.56
A variety of appropriate examples were used in all explanations and demonstrations.	25	3.60	.58	2.08	.11
A relaxed style was adopted when explaining or demonstrating.	25	4.04	.61	1.47	.24
Individual feedback and corrective instructions were provided.	25	3.68	.80	2.19	.09
Students were ensured to have experience success and feelings of competence.	25	3.48	.71	1.57	.26
Learning					
Students were more competent after training.	25	3.92	.70	1.36	.28
Students were enthusiastic and keen to learn various techniques.	25	2.84	.74	1.66	.19
Students were conscientious and responsible.	25	3.12	.83	3.9	.01*
Students were able to monitor their own learning.	25	3.16	.85	2.85	.04*
Organization					
Communication between laboratory teaching staff and university academic staff was adequate.	24	2.83	1.04	2.95	.04*
Communication between laboratory teaching staff and students was adequate.	25	3.8	.81	.91	.49
Students had adequate opportunities to perform various tasks relevant to their level.	25	3.36	.86	1.37	.27
The number of staff for student supervision was adequate.	25	3.44	.76	3.46	.02*
Clinical teaching does not interfere with laboratory staff's routine work.	25	2.44	.86	.60	.69
Personal gain					
The students' field placement provided laboratory teaching staff opportunities to improve skills in personal communication and organization.	25	3.52	.96	.90	.49
The clinical teaching experience had increased laboratory teaching staff's awareness of their strengths and weaknesses as teachers.	24	3.83	.63	.49	.77
Clinical teaching provided laboratory teaching staff with opportunity to gain further insight in professional development.	25	3.64	.81	1.48	.24
Clinical teaching enabled laboratory teaching staff to keep abreast of new techniques and theories of modern technology.	25	3.40	.81	.70	.62

*The mean difference is significant at .05 level.

In Table 22, significant differences in the means at different centres were observed in several items in the learning and organization dimensions but not the teaching nor the personal gain items. Teachers' perceptions on how students approach learning appeared to vary across centres, as indicated by the items 'students were conscientious and responsible' ($F=3.9$, $p=.01$) and 'students were able to monitor their own learning' ($F=2.85$, $p=.04$). Furthermore, relatively low mean ratings were obtained in 3 out of the 4 items in this category (mean = 2.84, 3.12, 3.16) indicating some concern. In addition, some teachers also showed reservations on the adequacy of communication between university and the placement facilities ($F=2.95$, $p=.04$) and this view varied among teachers from different centres. Although some teachers agreed that the number of staff for teaching was adequate some held contrasting views ($F=3.44$, $p=.02$). It appears that F test on individual item revealed significant means difference while no significant means difference was demonstrated between any hospital pairs in the post hoc test used to follow up significant ANOVA F (following Table 21) may be due to the fact that Tukey test is too conservative, but it does not imply any statistical contradiction. It is quite possible for ANOVA to detect differences between sites in general terms but for specific differences between individual sites to remain elusive.

**Measurements of perceptions differences between (i) students cohort 1 and 2
(ii) teachers cohort 1 and 2**

Table 23 – Comparison of students' post clinical training ratings on the four subscales between cohort 1 and cohort 2.

	Cohort	N	Mean	Std. Deviation	F-value	t	Mean difference	Sig. (2-tailed)
Clinical Teaching	1	66	3.39	0.44	.69	-1.03	-.09	.30
	2	31	3.49	0.39				
Learning	1	66	3.65	0.52	.47	.01	.00	.99
	2	31	3.65	0.54				
Organization	1	64	3.47	0.50	1.16	-1.08	-.11	.27
	2	31	3.58	0.41				
Personal gain	1	64	3.66	1.34	.51	.65	.01	.51
	2	31	3.65	0.44				

When comparison was made between the post training ratings of student

cohort 1 and cohort 2, (Table 23), again no significant difference in the means was found. Although the two cohorts were different groups of students, they had similar academic background and were pursuing the same objectives. Our expectation would be higher ratings from the second cohort when compared to that of the first student group if the interventions were successful. So, the results appeared to be a little disappointing. Nevertheless, higher overall means were found in the post training ratings of the second cohort on the subscales clinical teaching and organization. Higher means were also noted in most individual items of the post training ratings of the four subscales of the second student group which could have implied that this cohort were more positive after the clinical experience.

Table 24 – Comparison of the computed residuals of students' post training perception between cohort 1 and cohort 2

	Cohort	N	Mean	Std. Deviation	F	t	Mean difference	Sig. (2-tailed)
Residual teaching	1	55	-.04	.44	.71	-1.27	-.11	.20
	2	31	.07	.38				
Residual personal gain	1	54	.01	.41	.88	.32	.03	.74
	2	31	-.02	.46				
Residual learning	1	56	.01	.46	3.08	.27	.03	.78
	2	31	-.01	.55				
Residual organization	1	53	-.07	.48	.90	-2.12	-.21	.04*
	2	31	.13	.37				

*The mean difference is significant at .05 level.

To further investigate differences in post training perceptions between the two student cohorts, residuals were computed through regressions and compared by t test. As shown in Table 24, the only significant difference was found in the mean of the residuals of the subscale organization ($t = -2.12$, $p = .04$). The results suggest that the second group of students had displayed a more positive view of organization than the first group of students. When we reviewed the post training ratings of individual items in this category of the two groups of students, higher means were observed in most measures of the second cohort, including the items 'I have adequate exposure to different equipment' (cohort 1= 3.30, cohort 2= 3.61), 'theory and practical work were integrated at the laboratory' (cohort 1= 3.39, cohort 2= 3.61), and 'the hospital environment I worked in has contributed positively to my learning' (cohort 1= 3.57, cohort 2= 3.80). The results indicate

that there were indeed differences in perceptions between the two student cohorts on organization and it could have been that initial differences between the cohorts was the reason why differences were not revealed in the t test in table 23 performed earlier.

Table 25 – Comparison of ratings of the 2 cohorts of instructors of the four subscales (cohort 1 and cohort 2)

Cohort		N	Mean	Std. Deviation	F	t	Mean difference	Sig. (2-tailed)
Teaching	1	127	3.53	.51	2.36	-.38	-.04	.70
	2	27	3.57	.38				
Learning	1	129	3.24	.71	.13	-.11	-.01	.90
	2	27	3.25	.60				
Organization	1	128	3.14	.64	.06	-.33	-.04	.73
	2	26	3.19	.56				
Personal gain	1	129	3.37	.73	-.64	-2.36	-.40	.02*
	2	26	3.77	1.08				

*The mean difference is significant at .05 level.

Table 25 shows that there was no significant difference in the means between the perceptions of the two groups of teachers on the various subscales except personal gain. (t=-2.36, p=.02). The results suggest that the second teacher cohort was more positive with regard to various personal developments. However, it would be difficult to determine if the change was due to the effect of the intervention since feedback were anonymous, it would not be possible to track changes in individual teacher, or the reflection of a different set of opinions from another group of instructors, as 17 out of the 27 (63%) returned questionnaires were from individuals who had participated in the survey the first time.

Qualitative results (second cohort)

Summary of students' responses to the open-ended questions of the post training questionnaire:

Responses frequency in descending order	No. of times mentioned
1. What do you like most about the ways the clinical teacher taught you?	
allow understanding of the real practice	7
hands on practice	5
discussions and feedback	4
learn how to apply theory to practice	4
teaching strategies e.g. case study	4
guidance	2
encouragement	2
friendly, acceptance as a team member	2
2. What are the areas that you could suggest changes in clinical teaching?	
better time tabling	4
increase training time	3
add discussion session	2
staff too busy	2
increase hands on opportunity	1
clearer objectives	1
more interaction between staff and student	1
one teacher only	1
more guidance	1

Eighteen students responded to the open-ended questions. Students' comments reinforced their quantitative responses. They valued the practice opportunities, and had enjoyed the discussions, guidance and encouragement from teachers. They also felt that teachers were very busy. When compared to the responses of the first student cohort, teachers' busy schedule remained an issue, and could affect the clinical teaching. However, the major concern of insufficient practice opportunities reported by the first student cohort appeared to have declined in the second student cohort.

Clinical teachers' comments from the survey

	No. of times mentioned
1. To extend period of clinical training	1
2. Need feedback from students	2
3. To improve communication between university, hospitals and students	3
4. Need teachers training course	2
5. Students not enthusiastic	1
6. Request syllabus of other Biomedical science subjects	1

Eight teachers provided written feedback. Comments from clinical teachers had confirmed their quantitative results. Clinical teachers were concerned about the communication between university and hospitals. Suggestions offered by clinical teachers were very positive and would have positive impact on clinical teaching. It appeared that the second teacher cohort focused more on recommendations to improve the programme while the first teacher cohort had their attention on the identification of deficiencies of the programme.

Summary of results of the second stage

There were significant differences in the means between the pre and post training scores of the subscales clinical teaching and organization. A general increase in the means of the post training scores of all items were observed in these two categories. It appeared that students were more satisfied with the clinical teaching and organization after the placement. The positive change might be due to the change in teaching strategies or students' own learning approach, however, it would be too early to tell if this change of perspectives was the results of the interventions. Further investigation would be needed before any definite causal relationship could be established.

Learning outcome

It is postulated that students' learning outcomes are related to their clinical experience, in this connection, regression analysis was conducted to determine which variables perceived by students in the training programme best predicts

outcomes such as clinical training grades and students' cumulative GPAs. Hence the four variables: clinical teaching, learning, organization and personal gain were entered at the same time for analysis.

Table 26 – Regression analysis for predictors of students' Field Training Grade (N = 66)

Predictors	Standardized coefficients beta	Sig.
Clinical teaching	-.17	.22
Student learning	.17	.24
Organization of training programme	.19	.19
Personal gain	.31	.04

a) dependent variable : Field Training grade
Adjusted R² =.18

As shown in Table 26, when all the predictors were being considered simultaneously, 18% of the variance in the field training grade could be predicted from these four variables combined (adjusted R² = .18). Personal gain was the only significant predictor for field training grade.

Table 27 – Regression analysis for predictors of students' Grade Point Average (N = 66)

Predictors	Standardized coefficients beta	Sig.
Clinical teaching	-.01	.92
Student learning	.04	.78
Organization of training programme	.09	.55
Personal gain	.28	.08

a) dependent variable : Grade point average
Adjusted R² =.07

When clinical teaching, student learning, organization and personal gain were used in the regression analysis for predicting GPAs, it could explain 7% of the variance, however, none of the four variables appears to be good predictors for the GPAs.

Table 28 – Comparison of students' pre and post clinical training Grade Point Average (cohort 1 and cohort 2)

		Mean	N	Std Deviation	Paired Mean difference	t	Sig.
Pair	GPA 1	2.94	66	.39	-.02	-5.27	<.01*
Cohort 1	GPA 2	2.96	66	.39			
Pair	GPA 1	2.91	33	.50	-.03	-6.12	<.01*
Cohort 2	GPA 2	2.94	33	.48			

*The mean difference is significant at .05 level.

GPA = grade point average

In Table 28, paired sample t-tests were run on the pre and post training GPAs of the two student cohorts. The results show significant differences in their means indicating that the field training grade had probably made a significant contribution to students' GPA or the field training programme had positively influenced students' learning outcomes.

Table 29 – Comparison of the field training grades between cohort 1 and cohort 2

Cohort	N	Mean	Std. Deviation	F	t	Mean difference	Sig.
Grade 1	66	5.65	1.49	7.67	-1.42	-.35	.17
Grade 2	33	6.00	1.03				

Results in Table 29 show that there was no significant difference in the means of the field training grades between cohort 1 and cohort 2. However, an increase of 12.1% of students obtaining a grade B or above was observed in cohort 2. (Fig. 2: students with grade B or above in cohort 1 = 78.8%, cohort 2 = 90.9%). These results indicate that there was an improvement in students' learning outcomes although the difference was not sufficient to become significant at the traditionally used level of 5%.

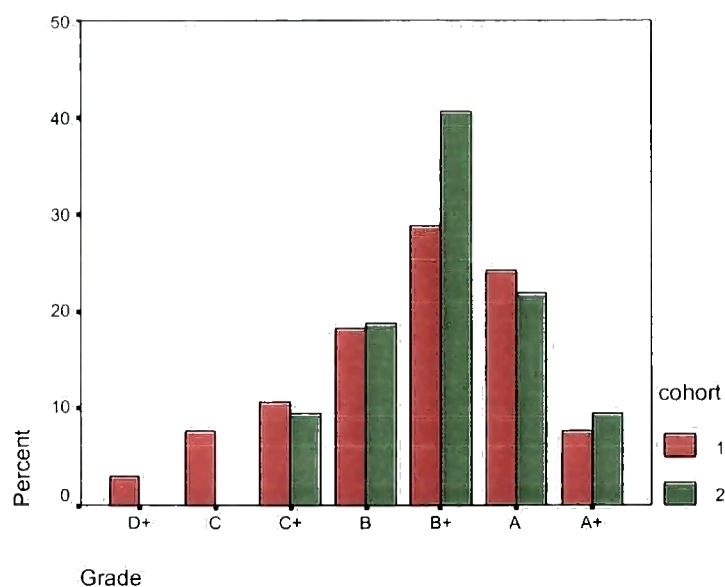


Fig. 2 Comparison of field training grades between cohort 1 and cohort 2

Table 30 – Comparison of the A level results between cohort 1 and cohort 2

Cohort	N	Mean	Std. Deviation	F	t	Mean difference	Sig. (2-tailed)
1	66	6.17	1.40	1.27	-3.12	-.95	.01*
2	33	7.12	1.45				

* The mean difference is significant at .05 level.

When the A level results of the 2 cohorts were compared (Table 30) significant difference in their means was found. The results indicate that cohort 2 appeared to have a stronger academic background than students of the first cohort.

Table 31 – Comparison of Students’ pre clinical training cumulative grade point average (cohort 1 and cohort 2

Cohort	N	Mean	Std. Deviation	F	t	Mean difference	Sig. (2-tailed)
1	66	2.94	.39	6.01	.32	.03	.74
2	33	2.91	.50				

* The mean difference is significant at .05 level.

However, no significant difference in the means of the pre-training cumulative grade point average was demonstrated (Table 31). The results suggest that academic achievement during the eighteen months of education in the university were similar between the two groups of students but that cohort 1 had made the most progress.

The use of data in practice

It is the intention of this evaluation exercise to assemble, analyze, and disseminate course data to enhance student learning. Data generated from this study had provided very useful information for the programme committee on what we appear to have been doing right and which areas needed improvement. As a result of this assessment, the student feedback questionnaire developed for this study has been used by both the biomedical science section and the nursing section of the Hong Kong Polytechnic University for evaluation of clinical placement since 2002. Two teaching workshops for clinical staff had been conducted, one in 2002 and one in 2003, and regular teaching seminars will be offered as continual professional education for clinical laboratory staff to promote clinical teaching starting summer 2004. A new clinical placement handbook with new objectives and assessment methods has been written and is being validated and tested on the 2004 cohort. It is the plan of the programme committee to introduce clinical problem based learning to the clinical attachment program as an alternative teaching strategy to enhance students' critical thinking and to encourage more active involvement of students in learning. A pilot run has just been completed in May 2004 in which three hospitals participated. A new clinical visit schedule has been drafted for academic staff which will be implemented in 2005 to improve communications between university and clinical staff. During the planning and implementation of these exercises, input was sought from the field, more meetings were held, thus strengthening the collaboration between the university and the service sector. Staff

have the responsibility to understand students' needs and this formative assessment had provided evidence to allow adjustments to be made. It was through this kind of feedback mechanism that teaching staff could respond to data and implement changes and it was also through this type of monitoring exercise that quality in education could be ensured.

Chapter 5 Discussions

Clinical practicum is a core component of the Biomedical Science curriculum. To prepare for their professional role, biomedical science students have to develop both their theoretical knowledge and clinical skills. It is in the arena of clinical education that students learn to integrate various skills with theoretical knowledge and transform them into practice (Dunn and Hansford, 1997). Previous researchers have reviewed many factors that may influence the development of students' clinical learning. In this study, quantitative and qualitative methods have been used to evaluate the effectiveness of the clinical training component from the perspectives of students, teachers and laboratory managers, to delineate the factors or areas that are facilitating or hindrance to the programme.

The four constructs identified through the questionnaires – 'clinical teaching', 'student learning', 'organization', and 'personal gain' - are used to guide the discussions on the quantitative and qualitative findings. Results are interpreted through integration of the three sets of data (students' pre and post clinical training questionnaires – cohort 1 and 2, clinical teachers' perception questionnaires – cohort 1 and 2 and laboratory managers' interviews), in an attempt to provide a clear picture on the effectiveness of the programme.

First phase of the study

Clinical teaching

In this study, when students' pre and post training views (first cohort) on clinical teaching were compared, results showed that their ratings had dropped significantly after the clinical placement ($p=.04$)¹. This corresponded to a moderate decrease in the magnitude of students' perceptions on this construct (Effect size = $-.31$)¹. It appears that 2 items in this subscale had influenced this change. Students felt that the 'learning objectives' ($p=.02$)² had not been 'communicated to them' and clinical teachers had not 'taken steps to ensure their progression' ($p<.01$)² to the

¹ Table 3 – Comparison of students' pre and post clinical training ratings on the four subscales (cohort 1).

level of their expectation. However, students appreciated that their clinical teachers were 'encouraging', 'open', 'listened to their views' and had 'plenty of opportunities to ask questions and discuss ideas'². Furthermore, although being placed at different centres, students' post training perceptions on clinical teaching were not significantly different ($p=.21$)³, suggesting that students had experienced similar teaching practice from teachers.

Clinical teachers (cohort 1) from different centres agreed that they had a clear understanding of the 'field training objectives'⁴. Their perceptions of clinical teaching were not significantly different. They had used a variety of 'teaching methods' to integrate 'theory and practice'⁴ for students' learning and had 'ensured that students had experienced success and feeling of competence'⁴. 'Individual feedback and corrective instructions'⁴ were provided to enhance progression of students' study. Nonetheless, clinical teachers from some centres did not share the view that 'teaching materials were prepared in advance' ($p=.01$)⁴ and teaching had not been conducted in a 'relaxed style' ($p=.02$)⁴. This might have been due to lack of time as reflected from the item in the 'organization' subscale that 'staff for student supervision' was inadequate.

Students' responses to the open-ended questions had reinforced their perceptions as described by the subscale 'clinical teaching' of the questionnaire. They valued 'discussions with clinical teachers', 'demonstrations with explanation from instructors', 'staff's willingness to teach', 'communication with teachers' and the 'monitoring of their progress' by mentors⁵.

Laboratory managers also echoed that teaching and learning is an 'interactive process' and they were clear about the 'programme objectives'⁶. They pointed out that an important role of clinical teachers was to 'facilitate students' learning' and that effective teaching required teachers to be 'knowledgeable, patient, be able to adopt different teaching strategies, to provide adequate feedback and to motivate students' learning '⁶.

² . Table 4 – Comparison of students' pre and post clinical training ratings of the subscale – clinical teaching (cohort 1).

³ . Table 8 – Comparison of students' post training ratings on the four subscales by centre (cohort 1).

⁴ . Table 13 – Comparison of clinical instructors' ratings on specific items of the four subscales by centres (cohort 1).

⁵ . Qualitative data of students' post training responses (cohort 1), p 72.

⁶ . Qualitative data of laboratory managers' interviews, p 74.

Findings of this subscale of the questionnaire broadly mirrored those of other studies. In Neville and French's study (1991), students viewed their clinical experience positively when their clinical teachers were encouraging and approachable. They enjoyed learning in a relaxed atmosphere with teachers using different teaching methods. They valued discussion sessions and the sharing of ideas with instructors. Barnard et al (2001) found that effective clinical teaching was associated with supportive learning climate, feedback, and communication of goals. Students rated highly teachers who were patient and enjoyed teaching but disliked interactions where there was no discussion and their opinions were not solicited. Constructive feedback was perceived by students as valuable in fostering their learning and development. However, students in both Barnard's (2001) and Lofmark's (2001) studies shared views with our students that feedback received from clinical teachers were insufficient. Communication of goals and the use of objectives to plan clinical learning were regarded as an important factor for effective teaching (Krichbaum, 1994; Bordley and Litzelman, 2000; Cearlock et al, 1999). Nevertheless, contrasting findings similar to our current study were presented in some other investigations (Barnard, et al 2001 and Lofmark, 2001). Although clinical teachers were clear about the programme objectives, students felt that these goals had not been communicated to them fully. It might be due to the assumption from the clinical teachers that students understood the objectives, since they were clearly stated in the student training handbook. However, programme goals are often broad and global which may not be clear to students. Provision of specific guidelines, therefore, would make it easier for student learning.

Organization

This dimension dealt with organizational arrangements provided by the clinical settings to meet students' needs. A negative change in students' perception (cohort 1) on the organizational aspect of the programme was evident ($p < .01$)⁷. The magnitude of decrease after the placement was moderate as indicated by an effect size of -0.44 ¹. This might be attributed to the disappointment from students as a result of lack of opportunities to practice on 'different equipment' ($p < 0.01$)⁷. It

⁷ Table 6 – comparison of students' pre and post clinical training of the subscale – organization (cohort 1).

appeared that the students in the present study had encountered the same practice obstacle as others (Lofmark, 2001; Baille, 1993). Clinical skills are central to all allied health education. In addition to professional development, actual performance of skills could promote students' confidence (Ford-Gilboe, et al. 1997), therefore, there is the need to ensure the provision of plenty of practice opportunities for students during clinical training. Apart from the practice issue, there was no significant difference between students' pre and post training views on other aspects in this category. In general, this group of students agreed that the hospital environment was 'harmonious' and had 'contributed positively to their learning', however, their feelings about being accepted as a member of the team was barely adequate⁷. This result is in discordance to other studies (Nolan, 1998; Neville and French, 1991). While students are adjusting to the new learning environment, they have to overcome the anxiety-provoking situations. Hart and Rotem (1994) declared that a trusting relationship with staff could enhance learning. It is only when students feel being accepted and understand what is expected of them that learning can proceed (Nolan, 1998). An appropriate length of rotation should be considered when planning the clinical placement to allow the establishment of a good staff-student relationship to maximize learning (Nolan, 1998).

In the current study, when perceptions of clinical teachers (cohort 1) from different centres on 'organization' were compared, they were content with the amount of communication between laboratory instructors and students. However, there was general consensus among them that communication between laboratory teachers and academic staff was inadequate as is reflected by a mean of 2.76 on the specific item⁴, which was not quite satisfactory. Some teachers felt that 'practice opportunities for student learning were not adequate' ($p < .01$)⁴, a view that was shared by the first student cohort. Strong feelings towards shortage of 'staff for students supervision' ($p = .03$)⁴ and 'clinical teaching had interfered with their routine service' ($p = .03$)⁴ were reported from teachers with varying degrees among centres. This could have explained why some clinical teachers did not 'prepare the teaching materials in advance' and 'teaching was not conducted in a relaxed manner' as reflected in the teaching category⁴. Because of the intensifying economic pressures, reduction of teaching resources is found across various health care disciplines. In order to meet service demand, most clinicians have to decrease

contact time with students. This condition has seriously undermined clinical education and severely affected staff morale (Gibson and Campbell, 2000; Lofmark, 2001). Ludmerer (1999) appeals to the medical profession that it is time to rectify the problems and to heal the medical education. Spencer (2003) commented that it is a difficult issue and urges the medical school to increase support for clinical teachers.

Students' qualitative reports confirmed the impact of organization had on their perceptions on clinical training. 'Practice opportunities'⁵ was the factor emphasized both as the most welcomed aspect when present and the change that was needed when missing⁵. Students enjoyed being treated as 'members of the staff'⁵ and had noted that 'clinical staff were too busy to teach'⁵. There were different opinions on the duration of clinical placement, some students preferred a longer training period while others suggested a shorter rotation⁵. The difference might be related to a positive or negative clinical placement they had experienced, however, no set pattern could be traced as related to a particular institution. Laboratory instructors had explicitly expressed their frustrations about the shortage of staff⁸, an organizational constraint as seen in many other studies (Lee, 1996; Seabrook, 2003). Department managers had concurred that this issue might compromise the quality of student supervision⁶. Echoing to the views of the clinical staff, laboratory managers also felt that communication between university and hospital staff was inadequate and could be improved⁶. Dunn and Hansford (1997) stressed the importance of effective communication between the health care and tertiary education sectors for quality clinical learning.

Student Learning

A common theme in the quantitative and qualitative data relating to 'clinical learning' subscale characterized the importance of students' own attitudes and approach to learning. There was a significant negative downturn on students' perspective (cohort 1) regarding learning on completion of their placement ($p < .01$)¹. This change was the highest among the four dimensions, with an effect size of $-.52$ ¹. Students reported that they had 'placed a lot of effort on the tasks assigned

⁸ Qualitative responses of clinical teachers (cohort 1), p 73.

to them'⁹ and had 'sought for solutions when encountering difficulties'⁹. However, it appeared that student had not spent as much 'time to prepare for the placement' the way they intended to, as the mean difference of their perception on this aspect between pre and post clinical training was significant ($p < .01$)⁹. This was an unexpected finding. In an informal discussion, students claimed that the demand for intense focusing during training had made them too exhausted to prepare for the placement. The scenario echoed a study by Hannon (2000), in which students were so occupied with clinical responsibilities that they could hardly find time to consult the literature. Indeed, there might be many reasons that had prevented students from preparing their studies in advance. Hart and Rotem (1994) suggested the adjustment to a different culture from that of the university could create difficulty for student learning. However, most students recognized that it was important for them to take the initiative, to show interest, and to be conscientious. They understood that their own approach to the placement would affect their learning (Baille, 1993). Clinical teachers were neutral to some of the factors that have been attributed to students learning such as 'enthusiasm, conscientiousness and independence'⁴ (statistical means of teachers' perceptions of these items were 3.06 and 3.05). Nevertheless, they were quite confident that students would be 'more competent after the training'⁴.

Comments from laboratory managers reflected the concerns they had on students' approach to learning⁶. Students were seen to be 'passive, lack of motivation and initiatives'⁶. Perhaps it is the 'Chinese people's culture'⁶ or perhaps it was due to 'poor job opportunities'⁶ that led to the passiveness of the students. Whatever is the reason, it is crucial to recognize that these characteristics may give rise to a negative clinical experience and impede learning and the issue has to be addressed. This concern was shared by some medical professionals that students in recent years had displayed a lack of commitment to their training which could affect the standards of practice (Seabrook, 2003). Laboratory managers recommended that in addition to technical skills, there was the need for students to develop communication skills, interpersonal skills as well as teamwork. These are the same attributes valued by other health care professions (Cross, 1998; Elder et al., 1997).

⁹ Table 5 – Comparison of students' pre and post clinical training ratings of the subscale – learning (cohort 1).

Both quantitative and qualitative results indicated that students had difficulties in taking initiatives, lacking motivation, unprepared for placement. The learning situation is less than ideal and warrants attention. While it is important for students to take an assertive approach in their own learning development, adequate support and guidance are required from teachers.

Personal Gain

The items forming the 'personal gain' dimension highlighted the elements of gains of students and clinical teachers (both of cohort 1). A significant negative change in students' perceptions was observed after their clinical rotation ($p=.03$)¹. The magnitude of change is of moderate level (effect size $=-.31$)¹. Most of the findings in the current investigation supported work from previous studies (Lofmark & Wikblad, 2001; Grealish & Carroll, 1998). Students perceived that the clinical training programme had enabled them to 'develop their professional skills'¹⁰. They felt that the placement had helped them to 'better understand patient care'¹⁰ and to 'appreciate their professional responsibilities'¹⁰. Students also valued the work-based experience they gained in clinical setting for it had promoted their 'confidence'¹⁰. Nevertheless, students felt that their clinical experience had not helped them to apply what they had learned to 'new situations' to the extent that they expected as reflected by a significant mean drop between students' pre and post training perception ($p=.04$)¹⁰. Since a key objective of clinical education involves transfer of previously learned knowledge to practice, improvement in this aspect is warranted.

Hesketh et al (2001) emphasized that clinical teachers should understand the teaching role and put educational theory into practice. An effective teacher should be responsible for her own self-development and keep up to date current advances in the field. Although most laboratory staff from different centres in the current study regarded that clinical teaching could provide them the opportunities 'to gain professional development'⁴ and to 'keep abreast of new techniques and theories of modern technology'⁴, some teachers from a few centres appeared to have divergent views. The difference was greatest between centre 1 (mean=3.75) and centre 5 (mean=2.75). It is apparent that findings in this study contrasted those

of Bordley & Litzelman (2000), who believed that clinical teaching could foster clinicians to better organize and consolidate their knowledge and to enhance their teaching skills. However, when teachers' views from different centres on personal gain were compared, some teachers neither agreed that clinical teaching could improve their 'communication and organization' skills ($p < .01$)⁴ nor approved the teaching experience could 'increase the awareness of their strengths and weaknesses as teachers' ($p = 0.04$)⁴.

Summary of the first phase of the study

Up to this point, both quantitative and qualitative data had revealed the impact of a broad range of factors on students' and teachers' perceptions on the clinical training programme. Findings of the current study suggested that students were in general satisfied with the encouragement, constructive feedback, and guidance provided by the clinical teachers. They agreed that the learning environment was conducive to learning and were positive on their gains from the programme. On the other hand, results indicated that teachers had employed appropriate teaching strategies including communication, feedback as well as the use of different teaching methods to foster students' learning. These are supporting factors for development of students' experiential learning. However, problems entailed in the clinical training programme had also been identified. It appeared that the organizational aspects and students learning approach were two areas that required attention. Students were at a loss because they were unsure of the learning objectives and were dissatisfied because of lack of practice opportunities. Teachers were frustrated because of staff shortage, lack of time to teach and meeting unmotivated students. In addition, inadequate communication between the academic institution and clinical facility had compounded the problem.

The quality of clinical education is dependent on the quality of students' clinical experience and effective clinical experience is related to both students' learning approach and the teachers' good teaching behaviors. Negative learning attitudes from the students would compromise their learning. Lack of time, resources and institutional support would in turn affect the quality of teaching.

¹⁰ Table 7 – comparison of students' pre and post clinical training ratings of the subscale – personal gain.



These intertwining relationships between teaching and learning are complex and these issues have to be addressed if improvement on the quality of clinical education is to be made.

Intervention - This study has identified areas that appeared to be deficient to students learning and were brought to the attention of the clinical training programme committee. Some recommendations were proposed to improve the learning development for students. The proposal included a comprehensive orientation to be delivered prior to the placement, to clarify the goals and learning objectives for students and to introduce to them the 'real' clinical learning environment through the sharing of experience by past students. Teachers were encouraged to employ various teaching strategies and feedback to motivate students. More frequent visits of academic staff to the clinical sites were scheduled to establish better links with the health care facilities. Clinical staff were invited to be honorary clinical instructors of the university to recognize their efforts and contributions to the programme. A teaching-skills workshop to focus on the instructional and personal development for clinical teachers was to be offered by the university. However, due to the initiation of a similar teaching programme by the Hospital Authority for their clinical staff, the university teaching workshop was not implemented and clinical staff attended the one offered by the Hospital Authority.

May and Veitch (1998) indicated that preparation of 'students for the placement experience', 'clinical teachers for the role of mentors' and 'the supporting role of academic staff' could influence students' learning. Hart and Rotem (1994) suggested that a good orientation programme would be helpful. Since students may not comprehend fully the learning goals to be achieved, it is important to provide a clear overview of the aims of the placement and to articulate the learning objectives of the clinical experience to students (Weeks et al, 2000), to allow them to have a clear view of the experiences that they will encounter and an understanding of why these activities are important to their learning. Students need to recognize the relevance of the learning experiences and how they could apply these knowledge and skills into their professional practice. The understanding of the relationship between goals and educational activities could motivate students. An investment to prepare students for the placement has clear benefits to students'

work-based learning.

Lack of preparation for the teaching role of clinical staff has been cited as a cause for dissatisfaction by members of almost all health care disciplines. Studies have indicated that this problem may well affect the quality of teaching (Neville and French, 1991; Lofmark, 1996; May and Veitch, 1998; Barnard, 2001 and Spencer, 2003) and needs to be addressed. It is evident that teaching course could enhance teaching skills, promote organizational development and stimulate enthusiasm (Wipf et al, 1999) and should be recommended to be part of the staff development. Indeed, many professions consider a structured education programme to improve clinical teachers' teaching performance is deemed appropriate and desirable. However, clinical tutors are often over stretched with their service responsibilities that they are not interested to participate in such activities. In addition, some members may not perceive that these training courses are related to teaching excellence and effective for their own personal development (Sachdeva, 2000). Therefore institutions must provide the time and resources to support staff development as well as extrinsic recognition to encourage clinical teachers to be more enthusiastic in joining the training programmes.

May and Veitch (1998) also stressed that liaison between academic and clinical staff is important for students' clinical placement. The liaison role of academic staff can help bridge the gap between higher education and the health care facilities. Effective communication between the two could enable collaboration, diminish barriers and enhance understanding of the needs and progress of students and is vital in providing a quality clinical placement programme. Kotlarz (1999) concurred that close articulation between the university and the service facilities is needed to ensure the provision of appropriate experience for students learning to strengthen the education system.

The Second Phase

Clinical Teaching

Ratings of the second student cohort on 'clinical teaching' had significantly improved upon completion of their placement ($p=.01$)¹¹. A modest increase in the magnitude of students' perceptions with an effect size of 0.55¹¹ was evident. The means of all items in this category were higher in the post training responses. Students were most positive about the attention given to them when clinical teachers 'listened to their views' ($p<.01$)¹² and 'discuss with them their ideas' ($p<.01$)¹² as shown by the significant means differences on students' perceptions between pre and post training. It appeared that clinical teachers had no difficulty communicating the 'learning objectives' to students ($p=.72$)¹² in the placement and had taken appropriate measures 'to ensure students' progression' ($p=.17$)¹² the way students had anticipated. Perspectives of the second student cohort on the last two items were different from those of the first cohort.

Clinical teachers (cohort 2) from different centres agreed that they understood the field training objectives and appropriate teaching strategies were employed in clinical teaching including using examples, providing feedback and preparation of teaching materials in advance¹³.

The overall qualitative feedback from students on the 'clinical teaching' dimension was positive and had supported the quantitative findings. Students enjoyed the 'guidance', 'encouragement', 'discussions', 'feedback' and the use of 'different teaching strategies' from clinical teachers¹⁴. However, they would welcome more 'interactions between teachers and students'¹⁴.

Clinical teachers suggested that their teaching would be improved if they could have more information on 'what was being taught in the classroom' and 'students' feedback'¹⁵. Indeed, positive feedback from students can provide teachers a sense of accomplishment and become the driving force for better

¹¹ Table 14 – Comparison of students' pre and post training ratings of the four subscales (cohort 2).

¹² Table 15 – comparison of students' pre and post training ratings of the subscale – clinical teaching (cohort 2).

¹³ Table 22 – Comparison of clinical instructors' ratings on specific items of the scales by centre (second cohort).

¹⁴ Qualitative responses of students (cohort 2), p 87.

teaching (Sachdeva, 2000) and an understanding of students' knowledge background could help clinical teachers to prepare learning tasks that are appropriate for the students. These comments reflected that clinical teachers understood their role and to adopt these suggestions would surely improve the quality of teaching.

Organization

There was an upward change in students' perspectives (cohort 2) on the 'organization' subscale. A moderate increase in the magnitude of students' views was observed between pre and post experience (effect size = 0.37)¹¹. When these pre and post training perceptions were compared, students appreciated that they were being accepted as members of the team, as significant means difference was obtained ($p < .01$)¹⁶. Being able to fit in promotes confidence in students, enhances their independence and enables them to further pursue self-directed learning (Nolan, 1998). Students agreed that they had 'adequate exposure to different equipment' ($p = 0.28$)¹⁶, a view which was different from that of the first student cohort. It appeared that opportunities to practice for this group of students were satisfactory. Nolan (1998) stressed that hands-on experience is important in clinical placement, for critical thinking can be developed through problems encountered during practice. Students' responses to other items were also more favorable after the placement and maintained that the 'learning environment'¹⁶ had a positive impact on their learning.

Students' qualitative response concurred with their quantitative data. 'Hands-on practice, friendly, acceptance as a team'¹⁴ are factors they considered valuable in clinical education. They noted that clinical teachers were 'too busy'¹⁴ and suggested that 'better time tabling'¹⁴ may balance some of the teaching and service demand from clinical staff.

¹⁵ Qualitative responses of clinical teachers (cohort 2), p 88.

¹⁶ Table 17 – Comparison of students' pre and post clinical training ratings of the subscale – organization (cohort 2).

When opinions of the second teacher cohort from different centres were compared, most clinical teachers seemed to be satisfied with the 'practice opportunities' available to students ($p=0.27$)¹³ which might imply an improvement in the arrangement for students' practice in this clinical session as a result of the intervention. However, some teachers did not share the same view. They were dissatisfied with the level of 'communication between clinical and university staff' ($p=0.04$)¹³ and concerned about the persisting 'staff shortage for students supervision' ($p=0.02$)¹³. They suggested that to improve clinical education, there should be better communication among academic staff, clinical teachers and students¹⁴. In addition, teaching development programmes should also be established to enhance their teaching skills¹⁵. It is obvious that effective communication between academic and clinical staff could enable the sharing of teaching experience which in turn could enhance education of students (Infante, 1986). Besides, through communication clinical teachers could provide more input and contribute more positively to the clinical education. Effective teaching has profound influence on students' learning and teachers' training programmes could provide clinical teachers an understanding of the theory of education, the various teaching principles and techniques as well as the different approaches to learning to promote their teaching excellence (Hesketh et al 2001).

Student Learning

The way students (cohort 2) perceived 'learning' had adopted a negative change after their training ($p=.01$)¹¹ and the magnitude was modestly large (effect size = $-.66$)¹¹. Results showed that this group of students had different view on 'time spent to prepare for the placement' post training ($p<.01$)¹⁷. It appeared that students' effort had only focused on 'the tasks assigned to them' and attention to 'preparation' might have been neglected. Even students appeared to enjoy the improved 'practice opportunities' and the 'guidance, feedback' from the teachers as indicated in the 'organization' and the 'clinical teaching' subscales, they appeared to be skeptical about the importance of study preparation to their learning.

¹⁷ Table 16 – Comparison of students' pre and post clinical training ratings of the subscale- learning (cohort 2).

There was significant perceptions difference on 'students learning' among this second group of clinical teachers from various centres. Some students were seen as not being 'conscientious' and 'irresponsible' ($p=0.01$)¹³ and teachers did not trust that they could 'monitor their own learning' ($p=0.04$)¹³. One teacher even commented that students were not enthusiastic on their learning¹⁵.

Personal Gain

The change of students' pre and post training perceptions on the construct 'personal gain' was not significant ($p=.10$)¹¹. Students agreed that the experience they gained from the clinical placement had given them the opportunities to practice, enhanced their confidence, and developed their professionalism. In addition, they felt that the field training experience had enabled them to apply knowledge to clinical practice¹⁸.

Clinical teachers agreed that teaching experience could enhance the development of interpersonal skills, professionalism and skills in teaching¹³.

It appeared that both students and teachers recognized the importance of clinical education and were satisfied with its outcomes.

Comparisons between the two student and teacher cohorts

When comparison was made between the post training perceptions of the two groups of students (cohort 1 and cohort 2) on the four subscales, the overall differences of the means were not significant (clinical teaching $p=0.30$; student learning $p=0.99$; organization $p=0.27$; personal gain $p=0.51$)¹⁹. However, a few individual items considered to be less than ideal by the first cohort, such as 'adequate exposure to different equipment' and 'clinical teachers took steps to ensure that I progressed well with my learning' were rated slightly higher by the second student group. When residuals, obtained by controlling for students' pre training perceptions, were used for comparison a significant finding was observed

¹⁸ Table 18 – Comparison of students' pre and post training ratings of the subscale-personal gain (cohort 2).

¹⁹ Table 23 – Comparison of students' post clinical training ratings on the four subscales between cohort 1 and cohort 2.

in the organization dimension ($p=.04$)²⁰. This indicated that indeed there was difference between the changing views of the two groups of students among centres. This change of perceptions may be due to an improvement in the teaching strategies or a change in expectations from the students.

Students' satisfaction is a measurement of the extent to which students' expectations were fulfilled and a reliable indicator of the effectiveness of a programme. Lloyd and Rosenthal (1992) argued that to improve students learning, it was essential to identify and acknowledge students' expectations. However, students' expectations are often shaped by their past experience, from reading or from peers, therefore, care has to be exercised to determine if these expectations are realistic, such that appropriate curricula could be designed to meet their needs.

Although personal gain was the only category showing a significant mean difference between the two teacher cohorts when their perceptions on the four dimensions were compared (clinical teaching $p=.70$; learning $p=.90$; organization $p=.73$; and personal gain $p=.02$)²¹, there were discordant views among teachers from different centres on items of other constructs. Findings suggested that the second group of teachers shared similar views to the first group on most aspects of clinical teaching, however, the second teacher group felt that they had better 'prepared teaching materials in advance' and teaching was being carried out in a 'relaxed manner'. With regard to the organization dimension, they seemed to be satisfied with the practice arrangements for the students, an area that was in accord with the views of second students group but was divergent from that of the first teacher cohort. This group of teachers in general agreed that the clinical teaching experiences allowed them to understand their role as teachers within the health service, and had promoted their organization and communication skills. While their perceptions concurred with those of the first teacher cohort that clinical placement could enable them to keep 'abreast of the new techniques and theories of the modern technology' the second group of teachers were more positive on the benefits of their professional development.

²⁰ Table 24 – Comparison of computed residuals of students' perception between cohort 1 and 2.

²¹ Table 25 – Comparison of ratings of the two teacher cohorts on the four subscales (cohort 1 and 2).

The Programme

Students' and teachers' perspectives in this study revealed many issues involved in the effectiveness of the clinical training programme. More favorable responses were found when compared to the negative ones, which may mean the programme is more supportive to students' learning. Moreover, a significant increase in the mean difference on the post training GPA ($p < .01$)²² was observed on both groups of students, reflecting a positive contribution of the field training to students' academic standing. Furthermore, results also suggested that the second group of students were more satisfied with the practice opportunities, and had better understanding on the objectives of the programme, while the second teacher cohort were more positive on their role of teachers. Although the difference between the field training grades of the two groups of students was not significant, an increase of 12.1% (Fig. 1) of students obtaining a grade B or above was observed. All of these findings may reflect a small but positive effect on the intervention.

However, factors concerned with students' attitudes, communications between academic and clinical staff as well as the shortage of clinical teachers for teaching had not been resolved. It appeared that strong support from the management is required to address the organization issues for effective teaching and learning of the programme.

Strengths and limitations of the study

To trace the effectiveness of the clinical training programme, a longitudinal study was conducted to gather information about the perceptions of biomedical science students, clinical teachers, and laboratory managers on clinical teaching, organization, students learning and personal gain.

Several strengths in this study deserve mentioning. First, the present evaluation has assessed both the process and outcome of the programme. Outcome assessments which focus only on the overall effect of a programme may produce equivocal answers, for there may be many possible explanations leading to the findings. Besides, the programme may not operate as planned (Tyler, 1942), hence,

²² Table 28 – Comparison of students' pre and post clinical training grade point average (cohort 1 and 2).

information obtained on both process and outcome provides additional understanding of the data, which helps to differentiate the effects. Detailed knowledge on how the programme is run can suggest causal factors linked to the effectiveness of the programme and provide directions to improvement of the programme. Second, various sources of information were sought, acquiring a range of views from students, teachers and laboratory managers on the teaching and learning aspects of the programme, and a multi-methods approach was also adopted with the use of both qualitative and quantitative methods to elicit perspectives from the participants on educational issues. These measures serve to triangulate the results thus enhancing the validity of the evaluation. Third, drawing on the opinions of students with clinical placement experience and from a review of other studies allow examination of specific issues pertaining to our programme as well as known factors attributable to the quality of similar programmes. Moreover, the use of open-ended questions and interviews help to capture the more complex events on the programme process. Fourth, as a member of the teaching team, the author is well acquainted with students and staff of the programme which makes invitation for participation of the study much easier.

There are limitations to the study. Since two different cohorts of students and teachers were surveyed, there may be variability in the general characteristics of the two groups – they may not be equivalent. Comparisons of A-level results and cumulative GPA of the two students groups were not able to give us a clear indication on the extent of difference between the two cohorts. A-level results showed the students of cohort 2 to be stronger in their academic background while achievement earned in the university were similar between the two cohorts as reflected in the pre clinical training cumulative GPAs. Besides the possible differences in academic standing, other confounding factors such as students' past experience, their relation with clinical teachers may lead to different perceptions. For example a good relation with the mentors may be more likely to provide a favorable evaluation and vice versa. Moreover, students tend to give a higher self-rating on their learning due to self awareness. Information sharing on the clinical training programme between the two groups of students in the induction course may have lowered expectations of the second cohort, resulting in lower pre training scores on various aspects of the programme which in turn could affect the interpretation of the effect of the interventions. The impact of all these factors on

students' perceptions cannot be ignored. Furthermore, the two cohorts may not have had the same clinical teachers. This could give rise to different learning experience. In addition, the shortage of laboratory personnel and increased workload may pose constraints on clinical teachers to implement intervention, for example, with heavy service duty teachers may not have adequate time to demonstrate or explain fully a particular procedure, to adopt new teaching strategies or to hold regular discussion with student even these are on their teaching agenda. Therefore how much change could be implemented is very much dependent on the hospital organization and resources. Since the small size of the sample may not be sensitive enough to allow detection of small changes in the perceptions of students and teachers, the progressive intervention effects may not be apparent when data on only two groups of students and teachers were studied. A more comprehensive longitudinal evaluation with more cohorts should be studied to reveal the true effects. Further, no attempt was made to explore the teaching preparation of clinical teachers which may affect student learning. The design did not involve random assignment to interventions and it is therefore impossible to ascribe causal inferences with certainty. Finally it should be noted that there can be disadvantages when the investigator is part of the work being studied, for issues such as subjectivity and ethics may be raised, and the advantages of an external perspective are missed.

Although the study was small and in a local context, the general findings have shown striking resemblance to studies from other health care disciplines and in other countries, reflecting the presence of some global issues, for example, a nursing study by Nolan (1998) from Australia, a research by Seabrook (2003) on medical education from UK, an investigation on clinical education by Neville and French (1991) in the physiotherapy discipline from UK, and a study by Kotlarz (1999) on Clinical laboratory Science from the USA. However, the current study involved students from only one local institution, further studies are needed to strengthen the reliability and validity of the study for generalization.

Chapter 6 Conclusions

This final chapter aims to draw conclusions about the effectiveness of the field training programme based on the analyses of the perceptions of students, clinical teachers and laboratory managers with reference to other studies and literature. Implications are drawn on the role of the university, the health care facilities and students in supporting the provision of quality of clinical education. Further implication is drawn on the use of evaluation to improve and enhance teaching and learning in higher education. Finally, the chapter offers a few suggestions for future research to better understand clinical education for further improvement.

Clinical education is a dynamic process. An array of literature from various health care disciplines clearly demonstrates that the quality of clinical education is related to the clinical experience of the students and this experiential learning could be influenced by a number of factors. Clinical practice, teachers' knowledge, skills and behaviors, the clinical learning environment, students' learning styles, communications between the educational institution and health care facilities may all have an impact on this process.

Clinical Teaching

Evidence of the current study is consistent with other research on the effectiveness of clinical teaching. Views and opinions of the students and clinical teachers in this study revealed that clinical teachers had adopted a variety of teaching methods to integrate theory and practice for students' learning. Teachers had provided students with encouragement, opportunities to discuss ideas and individual feedback with corrective measures. Students appreciated that teachers listened to their views, took steps to ensure that they experienced success, monitored their progression and were open to their suggestions. All of these are factors consistently identified as being associated with effective clinical teaching. Although students had expressed dissatisfaction on the communication of goals in the first part of the study, the issue appeared to have improved after their attendance of a comprehensive pre clinical briefing.

Teachers as facilitators need specific actions to guide students in their learning. Many studies have yielded data indicating the correlation of a number of specific teachers' behaviors with student learning. Articulating goals provides students with a clear understanding of the purposes and values of the activities, such that students can have a clear picture of what to expect, allowing them to make appropriate preparations. Listening to students enable teachers to understand more about the needs and anxiety of the students. This may serve to provide the necessary emotional support and to build a trusting teacher-students relationship. Through discussions, teachers can communicate to students the beliefs, attitudes and values of the profession and to lead them into professional socialization.

Encouragement is a means to motivate students and promote self-esteem. Feedback may seek to increase students' awareness of their knowledge, skills and attitudes, to promote their critical thinking and is an effective way of helping students to progress in their learning. Ensuring students had experienced success reinforces achievements, thus promote confidence in students. Teaching with a relaxed style provides an environment conducive to students' learning. To take steps to ensure students' progression, allow early detection of students' learning deficiencies such that assistance can be provided. Current findings reflected these characteristics.

Student Learning

The research findings have highlighted weak students' learning. Although students in this study reported that they had placed a lot of efforts on their assignments and had sought to resolve problems when encountering difficulties, there were concerns from clinical teachers and laboratory managers on students' approach to learning. Students were seen to be passive and lacking in initiative.

Extensive discussions have been documented on the process of learning. The way student approach to learning is dependent on their own characteristics, past experience, and perceptions on the tasks as well as learning environment. Teaching and learning are interrelated processes and require concerted effort from both teachers and students. It is the responsibility of the teachers to guide and

facilitate students' learning, however, if students do not actively participate in the process, learning will not be successful.

Empirical evidence from this study points to the need for investigation on the lack of motivation on students. Both academic and clinical teachers are urged to develop better communication with students to explore what stems the indifference and to provide appropriate strategies to encourage and motivate students to take a more assertive and active role in their own learning.

Organization

The research findings confirmed the significance of learning environment to clinical education. Many analyses have shown that a conducive environment is crucial to student learning. This includes acceptance of students as members of the team and provision of adequate opportunities to practice. To feel being accepted reduces students' anxiety and provides them a sense of belonging. When they can identify their role with the team they become more confident and that in turn promotes their willingness to participate, thus enhances their skills development. Results of the students of the current study supported the value of acceptance. Similar to the other health care professions, biomedical science is a practice discipline, thus development of practical skills is essential. Practice opportunities allow students to improve their technical skills, to integrate theory and practice, to apply knowledge into action and to promote critical thinking as they encounter problems. This is evident from students' increased satisfaction in the second phase of the study after improvement in hands-on opportunities.

An organized structure is important not only to students but also to teachers. Seabrook (2001) and Grant (2003) discussed the negative impact of lack of institutional support on teachers' morale and practice. Therefore management should value clinical teaching and provide funding and a reward system to support clinical teaching. Results from this study have clearly indicated that shortage of staff for student supervision is acute and may influence students' learning. This weakness is also seen in other health care professions. Unless these practical problems are resolved teachers will continue to be distracted, preventing them to consider broader educational issues. In this era of budget constraints, however,

alternatives may have to be developed to overcome this difficulty. The data relating to the weak communication between the university and the service hospitals is of concern. The importance of partnership cannot be overstated, communication between tertiary and the health sectors enables the identification of gaps and the provision of well designed and effective programme. Therefore, appropriate arrangements have to be made to promote effective collaboration between the two facilities to enhance quality of teaching and learning.

Personal Gain

Clinical education aims to develop students' confidence, to enable students to translate theory into practice, to develop students' competence in technical and analytical skills, to foster students' ability to resolve problems, to develop professionalism and to acquire a holistic view on health care. Students in this study perceived that the programme has equipped them with the confidence, the professional skills and responsibilities, the ability to transfer knowledge to new situations and to better understand patient care, similar to many other investigations.

Views of the clinical teachers on clinical teaching were positive. They perceived that clinical teaching could help them to improve organization and communication skills, to better understand education scholarship and to provide opportunities for professional and personal development.

Implications

The biomedical science students' and clinical teachers' perspectives, as defined in this study help to describe the issues in a clinical training programme in Hong Kong. Practice opportunities, students' learning attitudes, communications between academic and clinical teachers and shortage of staff are problems that need to be addressed. Appropriate strategies have to be established to respond to these issues to ensure effectiveness of the programme. To achieve changes require collaborative efforts from all stakeholders, and the conclusions drawn from the current study have implications for the university, academic staff, health care sectors, the clinical teachers and students.

Implications for the university and academic staff

Lack of communication between academics and clinical teaching staff was strongly highlighted in this study. Communication is essential in the provision of an effective program when joint efforts are required from both the university and hospitals. Effective communication enhances understanding of the aims and objectives of the programme, operational and organizational issues and active involvement of the staff. The major implication for the university is to take the lead to actively collaborate with the health care facilities to plan and design the programme, to develop responsive strategies to meet the needs of the students. Better communication channels should be in place for both students and teachers to inform programme committee for continuous improvement. Academic staff should strengthen liaison with clinical teachers on a regular basis to closely monitor students' progress and to adequately prepare students for the placement. Much has been learned about attributes of effective clinical teachers and how excellence could be promoted, however, this would be difficult to achieve without the support from the institution. Therefore, a reward systems to recognize the contributions of the clinical teachers, for example, to invite clinical teachers to be honorary clinical associates of the university where they can enjoy the use of the university's facilities and to participate in university's workshops and seminars. To support clinical teaching, the university should implement teachers' training courses to further clinical teachers' instructional, organizational and personal skills development.

Implications for the health care facilities and clinical teachers

The implication for the health care facilities is to create a culture to support the development of educational scholarship. Discourse on educational issues and teaching excellence should be promoted among clinical staff as a catalyst to search for new approaches to improve clinical teaching and learning. There should be support from the senior management to enhance intrinsic worth of teaching and to encourage responsibility in teachers. Evidence of shortage of clinical teachers for students' supervision has resource implication. Indeed, clinical placement is expensive to run, however, with diminishing financial support, it will be difficult if

not impossible to acquire additional funding for clinical education programme. Alternative teaching approach such as group teaching may have to be developed to replace the one-to-one teaching.

The characteristics of good clinical teaching as perceived by students were confirmed in this study. It is essential for clinical teachers to reflect the positive teaching attributes, to offer useful feedback and to provide a good learning environment to foster students learning. It will also be useful for teachers to examine their teaching approaches and to explore new ways to motivate students' learning.

Implications for students

Although teachers are responsible for creating a climate that is conducive to learning and to adopt different strategies to teach and motivate students, students should recognize that knowledge is not sustained by simply reproducing materials without understanding the interconnectedness of information. They should also realize the way they learn determines to a substantial degree of what they learn. Effective learning could only be achieved when students take an active approach with a conscious effort to make that happen. Moreover, students should provide feedback to teachers as to how teachers could help them through more effective teaching. Any improvement needs the joint efforts of everyone participating in the process, with constructive suggestions students can exert their influence to develop a better curriculum and learning environment.

Evaluation – An Element for Quality

Quality is an elusive concept and its meaning varies among individuals. Each person may have a different perspective about quality subject to his own interest. Some may associate quality with prestige, some see it as a conformity to standard and some may judge quality according to how well it fits its purpose. These different ideas would undoubtedly influence the approaches adopted for assessing the desirable outcomes.

Quality in education is clearly linked to purpose and the purpose of education is to foster student learning and development. In search of improvement in the educational process can improve the educational outcomes, thereby, quality is achieved.

Improvement is a process involving changes through examining and reviewing existing practices. Evaluation could serve as a means to critically interrogate these practices, for it is a systematic approach to monitor programme activities. Through evaluation, evidence can be generated to identify the needs of students, to unveil the structure and organization of a course, to trace the way a programme is being delivered or to measure the effectiveness of a programme. The information could serve as feedback to the interested parties to formulate interventions and make course adjustments. By repeating this process, evaluation becomes a perpetual event to continuously promote students' learning, hence producing quality education.

Under the current climate of increased accountability, higher educational institutions are held responsible to provide evidence of quality education. This requires universities and colleges to develop effective mechanisms to study, review, and to reflect their own practices to determine the extent of contributions to the development of students' learning. If quality development is to become an institutional goal, certain strategies have to be established. Higher educational institutions have to be proactive and to develop a culture to promote quality improvement. An effective approach is to instill in staff the value of quality development and to make clear to them that improvement needs collaborative effort from everyone engaged in the educational process, the teachers, students and the institution. Staff should be encouraged to build a monitoring system into their practice and be allowed the freedom and space to develop their own agenda towards improvement. Quality enhancement is sustainable only when it is derived from an internal capability of staff's and institutions' commitment.

Being close to the daily operation of the programme, teachers could institute into their work a system of evaluation. With the fundamental principles of measurement of validity and reliability in mind, teachers could try develop effective instruments to look into the actual teaching process, educational outcomes,

learning environment and many other aspects reflecting the broader goals of the institution. Such practices could ensure contributions to quality improvement.

Future Research

Assessing the effectiveness of our field training programme is a difficult but vital task to be undertaken. In this study, we have taken a close examination at the factors influencing teaching and learning on two groups of students and the impact of the interventions. Although the differential effects of these factors have been identified, certain questions have arisen. For example: What leads to the passiveness of students in this study? Is there a relationship between individual teachers' behaviors and perceptions of students? Have teachers received teachers' training prior to students' placement and would this make a difference to students learning? How could we better measure the impact of interventions to improve students' learning? These aspects need to be further explored in future research to gather information for further improvement of our programme. In addition, new instruments may need to be developed, such as, to use focus group and a more comprehensive qualitative approach to study in-depth the experience of students to determine the reasons associated with students' motivational problems. We may also need to extend the research to include more cohorts and to use random assignment to reveal the real impact of the interventions.

While recognizing the limitations of this small scale study, it is hoped that findings from the research could inform both the academic and clinical colleagues the needs of the students, the strengths and weaknesses of the programme for actions to improve the programme. It is also hoped that this study would contribute more broadly to the development of quality education.

End of Thesis

Appendix A1 Pre

The Hong Kong Polytechnic University Department of Nursing and Health Sciences

Questionnaire for Evaluation of Field Training Programme

This questionnaire is intended for improving the clinical attachment programme. Your participation is strictly voluntary. The information collected will be kept confidential and only be used internally. Your support in completing this questionnaire will help us develop a better curriculum for our Biomedical Science programme and we thank you for your cooperation.

Student signature: _____

Student name: _____ Hospital: _____ Date: _____

5 4 3 2 1
 Strongly agree Agree No opinion Disagree Strongly disagree

1.	The clinical teacher will clearly communicate the learning objectives to me.	5	4	3	2	1
2.	The clinical teacher will take steps to ensure that I progressed well with my learning.	5	4	3	2	1
3.	It is difficult to know what is expected of me in the clinical areas.	5	4	3	2	1
4.	The clinical teacher will listen to my views and open to suggestions.	5	4	3	2	1
5.	I will spend time to prepare for the placement.	5	4	3	2	1
6.	I will attempt to seek for solutions to difficulties I encounter.	5	4	3	2	1
7.	I will place a lot of effort on the tasks assigned to me.	5	4	3	2	1
8.	I will have adequate exposure to different equipment.	5	4	3	2	1
9.	The working environment is harmonious.	5	4	3	2	1
10.	The clinical teacher will encourage me to perform a variety of clinical techniques.	5	4	3	2	1
11.	I will be more confident to perform tasks that I have learned in clinical rotations.	5	4	3	2	1
12.	Theory and practical work are integrated at the laboratory/ward.	5	4	3	2	1
13.	My hands on experience will further develop my professional skills.	5	4	3	2	1
14.	Clinical training will help me to appreciate my future professional responsibilities.	5	4	3	2	1
15.	I will learn how to transfer my knowledge to new situations.	5	4	3	2	1
16.	The hospital environment will contribute positively to my learning.	5	4	3	2	1
17.	There will be plenty of opportunities to ask questions and discuss ideas with my clinical teacher.	5	4	3	2	1
18.	Working in the clinical setting will enable me to better understand patient care.	5	4	3	2	1
19.	Laboratory staff will accept me as a member of the team.	5	4	3	2	1
20.	The working environment is neat and tidy.	5	4	3	2	1

Appendix A2 Post

The Hong Kong Polytechnic University Department of Nursing and Health Sciences

Questionnaire for Evaluation of Field Training Programme

This questionnaire is intended for improving the clinical attachment programme. Your participation is strictly voluntary. The information collected will be kept confidential and only be used internally. Your support in completing this questionnaire will help us develop a better curriculum for our Biomedical Science programme and we thank you for your cooperation.

Student signature: _____

Student name: _____ Hospital: _____ Date: _____

5 4 3 2 1
 Strongly agree Agree No opinion Disagree Strongly disagree

1.	The clinical teacher clearly communicated the learning objectives to me.	5	4	3	2	1
2.	The clinical teacher took steps to ensure that I progressed well with my learning.	5	4	3	2	1
3.	It was difficult to know what was expected of me in the clinical areas.	5	4	3	2	1
4.	The clinical teacher listened to my views and was open to suggestions.	5	4	3	2	1
5.	I have spent time to prepare for the placement.	5	4	3	2	1
6.	I always attempt to seek for solutions to difficulties I encounter.	5	4	3	2	1
7.	I have placed a lot of effort on the tasks assigned to me.	5	4	3	2	1
8.	I have adequate exposure to different equipment.	5	4	3	2	1
9.	The working environment is harmonious.	5	4	3	2	1
10.	The clinical teacher encouraged me to perform a variety of clinical techniques.	5	4	3	2	1
11.	I am more confident to perform tasks that I have learned in clinical rotations.	5	4	3	2	1
12.	Theory and practical work were integrated at the laboratory/ward.	5	4	3	2	1
13.	My hands on experience has further developed my professional skills.	5	4	3	2	1
14.	Clinical training has helped me to appreciate my future professional responsibilities.	5	4	3	2	1
15.	I have learned how to transfer my knowledge to new situations.	5	4	3	2	1
16.	The hospital environment I worked in has contributed positively to my learning.	5	4	3	2	1
17.	There have been plenty of opportunities to ask questions and discuss ideas with my clinical teacher.	5	4	3	2	1
18.	Working in the clinical setting has enabled me to better understand patient care.	5	4	3	2	1
19.	Laboratory staff has accepted me as a member of the team.	5	4	3	2	1
20.	The working environment was neat and tidy.	5	4	3	2	1

1. What do you like most about the ways the clinical teacher taught you?

Evaluation on the effectiveness of the field
training programme

This questionnaire is part of an evaluation of the effectiveness of the clinical training programme which I am conducting in partial fulfillment of the requirements of a doctor in education programme. The aim of this survey is to help our department to improve the curriculum in Biomedical Science. Please be assured that all data collected will be kept strictly confidential and used only for academic purposes. I earnestly appeal for your kind assistance to complete the questionnaire and return it to me in the enclosed self-addressed envelope before **September 15, 2001**. My sincere thanks to you for sparing your precious time in advance.

Researcher: Maria Wong
Department of Nursing and Health Sciences
The Hong Kong Polytechnic University

Personal particulars:

1. Your job title (MLT II, MLT I, MT, SMT, DM etc.)

2. Your Gender: M ☐ F ☐

3. The highest qualification you have obtained: _____

Highest qualification: _____ (field of study _____)

4. Years of service in pathology laboratory _____

5. Your institution _____

6. I have completed this questionnaire last year. (yes no)

Please circle the number that best reflects your agreement or disagreement with the following statements (1 = strongly disagree and 5 = strongly agree)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Students' field training objectives were made clear to laboratory teaching staff.	5	4	3	2	1
2. Communication between laboratory teaching staff and university academic staff was adequate.	5	4	3	2	1
3. Communication between laboratory teaching staff and students was adequate.	5	4	3	2	1
4. Theory and practical work were integrated at the laboratory in clinical teaching.	5	4	3	2	1
5. Students had adequate opportunities to perform various tasks relevant to their level.	5	4	3	2	1
6. Relevant teaching materials were prepared in advance by laboratory teaching staff.	5	4	3	2	1
7. A variety of appropriate examples were used in all explanations and demonstrations.	5	4	3	2	1
8. A relaxed style was adopted when explaining or demonstrating.	5	4	3	2	1
9. Individual feedback and corrective instructions were provided.	5	4	3	2	1
10. The number of staff for student supervision was adequate.	5	4	3	2	1
11. The students' field placement provided laboratory teaching staff opportunities to improve skills in personal communication and organization.	5	4	3	2	1
12. The clinical teaching experience had increased laboratory teaching staff's awareness of their strengths and weaknesses as teachers.	5	4	3	2	1
13. Students were more competent after training.	5	4	3	2	1
14. Students were ensured to have experience success and feelings of competence.	5	4	3	2	1
15. Clinical teaching does not interfere with laboratory staff's routine work.	5	4	3	2	1
16. Students were enthusiastic and keen to learn various techniques.	5	4	3	2	1
17. Students were conscientious and responsible.	5	4	3	2	1
18. Clinical teaching provided laboratory teaching staff with opportunity to gain further insight in professional development.	5	4	3	2	1
19. Clinical teaching enabled laboratory teaching staff to keep abreast of new techniques and theories of modern technology.	5	4	3	2	1
20. Students were able to monitor their own learning.	5	4	3	2	1

Please give any comments or suggestions regarding possible changes or improvements to the field training programme.

Interview guiding questions

1. What is good clinical teaching?
 - Role of clinical teachers
 - Facilitator
 - Objectives
 - Feedback
 - Communication
 - Teaching strategies

2. What constitute effective learning?
 - Learning attitudes
 - Initiatives
 - Motivation
 - Knowledge
 - Hardworking
 - Team player
 - Critical thinking

3. Do you think a more structured programme is needed?
 - Issues
 - Staff resources
 - Communication between university and placement centres
 - Learning environment

4. Do you think clinical teaching staff benefit from their teaching experience?

Consent to participate in research

Project title:

An evaluation of the clinical training curriculum of the Biomedical Science programme

The aim of the project is to help our Department to improve and further develop our programme. In addition to obtaining your response on the questionnaire, we would appreciate it if you could give us your consent to use the academic results (e.g. GPA) from your student records for this study. Please be re-assured that all data collected will be kept strictly confidential and information will only be reported in aggregate scores and **NOT** directed at an individual level, hence, no individual will be identified.

I understand the nature this study and my participation in the study is voluntary.

Name of the participant _____

Signature of the participant _____

Consent Form

The interview is part of a survey for my dissertation on “An Evaluation of the Clinical Training Curriculum of the Biomedical Science Programme”. The aim of the project is to improve the clinical attachment programme. The information collected will be kept confidential and only be used internally. Your participation is strictly voluntary and you have every right to withdraw from the study at any time. Your support of the project is greatly appreciated.

Researcher: Maria Wong, Department of Nursing and Health Sciences, The Hong Kong Polytechnic University

Name of participant _____

Signature of participant _____

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